

ROYAL BOTANIC GARDENS, KEW.

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[1919

VII.—NEW ZEALAND FLAX.

(*Phormium tenax*).

(With Plates).

INTRODUCTORY.

The possibility of growing New Zealand Flax (*Phormium tenax*, L.f.) as a commercial undertaking in the British Isles has for some years been a matter of interest and experiment with certain landed proprietors in Scotland and Ireland. The matter has also been of considerable interest to Kew since its successful introduction to the Royal Gardens through the enterprise of Sir Joseph Banks in 1789.

An account of the early distribution of the plant from Kew is given in the Botanical Magazine, vol. 59, 1832, plate 3199, and by that time it had proved its suitability for cultivation both in Inverness-shire and at Salcombe in Devonshire, and Sir William Hooker pointed out that "the South of Ireland would in all probability be found to be well suited to its growth and increase."

Sir Joseph Banks, too, in Cook's first voyage, quoted in the Botanical Magazine, says of New Zealand flax that it "would certainly be a great acquisition to England, where it would probably thrive with very little trouble; as it seems to be hardy, and to affect no particular soil; being found equally in hill and valley, in the driest mould and the deepest bogs. The bog, however, it seems rather to prefer; as near such places we found it to be larger than elsewhere."

Since these early efforts to spread a knowledge of New Zealand Flax and its value as a commercial possibility, several more recent attempts have been made to assist in the development of an industry by advice and with the supply of plants for cultivation.

That *Phormium tenax* is amenable to cultivation in the open in the British Isles has long been known, but whether it can be regarded as proved that its cultivation is likely to be a commercial success is still held to be doubtful. One reason which accounts for the doubt as to the suitability of *Phormium* for

extensive cultivation is that the variety with drooping leaves, usually grown in gardens, is not the form which gives the best yield of fibre. The other and more weighty reason is that attempts have been made to grow New Zealand Flax in places for which it is not suited. In such places it may grow, but the growth is so slow that, as a commercial undertaking, there could be no possibility of success.

In order to overcome the first difficulty the Director of Kew approached the High Commissioner for New Zealand some years ago with the request that plants of the best fibre-yielding varieties of *Phormium* might be sent over from New Zealand for experimental cultivation in the British Isles.

The first consignment of plants from New Zealand reached Kew in September, 1914, and consisted of eighteen named varieties, and the following list of their names was supplied by the High Commissioner:—

Awanga	Putaiore
Pare Tarewha	Ngatanui
Arero Whara Whara	Pare Kori
Tutaemanu	Tamatea
Parakawariki	Tupari
Mukama	Hutero
Oene	Rautamoa
Katirawkawa	Matukaroimata
Tihore	Kopupungawa.

Sets of these plants were distributed to the Scottish Board of Agriculture, the Irish Department of Agriculture, the Marquess of Lansdowne, Derreen, Co. Kerry, and to the late Mr. T. A. Dorrien-Smith, Tresco, Isles of Scilly. The four plants which survived at Kew were sent for trial to the Magnetic Observatory, Eskdalemuir, Langholm, Dumfriesshire.

We learn from Major A. A. Dorrien-Smith that two of the varieties are growing well at Tresco Abbey. One is a strong-growing, long-leaved form with leaves some 8 ft. long, curved over at the top, glaucous in colour with a brown mid-rib, the other is a dwarf form of spreading habit with erect pale green leaves. The names have unfortunately been lost. The plants sent to Eskdalemuir succumbed to the severe frost in the winter of 1915, so that the higher moorland of Scotland does not appear to be suitable to the growth of New Zealand Flax.

Thanks to the kind offices of the High Commissioner a further consignment of *Phormium tenax* was received at Kew from New Zealand in July, 1915, but of these only six arrived in a living condition and at the present time there is only one survivor, the others having succumbed to the cold of the winter at Kew.

In December, 1918, another consignment of seventeen named varieties was sent over from New Zealand at the request of the High Commissioner and arrived in very good condition.

In order to test the suitability of these plants for British conditions they have all been sent to the Rt. Hon. Lord Ventry, at Burnham, Dingle, Co. Kerry, for trial under conditions most likely to be favourable to their growth and the experiment will be watched with interest.

The consignment consisted of the following varieties:—

Koroekihī	Tamatea
Oue	Ngutunui
Awanga	Tutaemanu
Wharariki	Raukama
Aerowharawhara	Tihore
Huhiroa	Putaiore (from Taranaki)
Ate	Katiraukaroa
	Hill Variety.
Pare-Kori-tawa	} Both types of variegated are known by the same name.
Pare-Kori-tawa	

With regard to the localities in the United Kingdom where New Zealand Flax may be expected to be a success, Cornwall and parts of Devon in England, the W. of Scotland and the S., S.W. and N.W. of Ireland may be mentioned as the most likely places.

In S.W. Scotland the plant has been cultivated on an extensive scale by Mr. J. Wallace, Loch Ryan House, Stranraer, with very promising results and by Mr. J. A. Campbell, Arduaine, Argyllshire. In Ireland extensive plantings have been made in Co. Kerry, which have proved that a New Zealand Flax industry in that county, and possibly also in Co. Cork, has every prospect of success.

Experiments have been tried in other parts of Ireland, under the auspices of the Irish Department of Agriculture, in Wicklow in particular, with the object of testing the possibility of setting up a profitable industry in Ireland. The results have been disappointing. This is hardly a matter of surprise since the places chosen for the experiment were quite unsuitable; it is, however, somewhat unfortunate, since considerable weight has been attached to the failure of these experiments and the adverse results have been held to prove that there is no chance of establishing a profitable industry in the country.

Since, however, in the course of the enquiries instituted by Kew, we have learnt that *Phormium* can be grown with success in S.W. Ireland and in the W. of Scotland, it seems desirable to place the matter on record, and to this end an invitation was sent to the Rt. Hon. Lord Ventry, Burnham, Dingle, Co. Kerry, asking him to contribute an account of his experiments with New Zealand flax for publication in the *Kew Bulletin*. With this request Lord Ventry very kindly acquiesced and has sent the following account of his work in Co. Kerry with several photographs, some of which are reproduced in this article, showing the rapid growth which the plants have made.

Lord Ventry has been growing the 'Powerscourt' and five other varieties of New Zealand Flax, and it may be that one of the varieties recently received from New Zealand and sent to him for trial will yield even better results than he has already obtained. Whether this be so or not, the evidence goes far to show that the possibility of growing *Phormium tenax* in S.W. Ireland as a commercial undertaking is an established fact.

Lord Ventry's account is of value more particularly because he has dealt with the cultivation of the plant and given full details as to the system he has adopted, the nature of the soil most suitable for its growth, the yield of fibre and the time taken to produce a crop.

With regard to the future commercial value we are not directly concerned, but it seems clear that if the fibre grown in this country can be used for such purposes as that imported from New Zealand, its success as an industry should be assured.

Before giving Lord Ventry's account of his experiments, the experiences of Mr. Wallace in the S.W. of Scotland, and of country can be used for such purposes as that imported from New Zealand flax, are recorded.

Mr. Wallace, of Loch Ryan House, Stranraer, has furnished the Director with the following particulars as to his experience with New Zealand flax:—

"The plant is easy to grow and it will grow in almost any soil and will stand up to 20° of frost. There are many varieties of the plant, but only comparatively few of them are suitable for cultivation in this country as a fibre plant. While it will grow in almost any soil, it undoubtedly does best where there is moisture present, even in absolutely swampy places.

"The plant takes a long time to come to maturity from seed or even from division of old plants, both of which methods of propagation succeed quite well. I find home-grown seed does better than imported seed from New Zealand.

"I find it means locking up land from 8-10 years before a first cutting can be got, so would not be inclined to plant arable land with it. Swampy, wet land and rough hillsides; where bracken grows strong, suit it well and such places might very profitably be planted with it. I had a few tons of fibre extracted by an experimental machine the year before the war commenced and got an excellent report on the fibre from the ropemakers some of it was sent to to be made into binder twine.

"It produces seed freely in this country and the plants are easily raised. My experiments have all been made near the sea.

"After reaching maturity a certain number of leaves may be cut every year or the plant may be cut over entirely every third or fourth year. Both methods, I believe, are practised in New Zealand.

"I incline to think that cutting the outside leaves of each crown every year is the more satisfactory method and gives a more regular fibre both as regards length and strength. The main objection to annual cutting is that it entails more labour.

"As to its uses, it is, of course, a very strong and long fibre, and it is in great demand for the making of binder twine. I understand the Navy do not favour the use of ropes made of it as it does not take tar well but has to be oiled if used in water. The Maoris make a fine cloth of it and I believe the Japanese use a fine quality of it to adulterate silk.

"It could be used for almost anything that a strong fibre is wanted for.

"The fresh leaf can be used, torn into strips, for garden tying."

Mr. J. Arthur Campbell, of Arduaine, Argyllshire, writes as follows as to his experiments in cultivating New Zealand flax:—

“Some years ago, when there was a good deal of talk about bringing in a ‘Small Holders Bill,’ knowing how difficult it was for people with a small holding to make a living off our West of Scotland land, I suggested to the Congested Districts Board that as *Phormium tenax* grew well in my garden here in peaty soil, and as New Zealand was at that time exporting fibre to the value of a million sterling, it was worth their while experimenting with its cultivation and endeavouring to get the industry started in this country in the congested districts.

“As nothing appeared to come of it I decided to experiment with it myself.

“I procured seed from New Zealand but as it failed to germinate I decided to try home-grown seed. This was kindly supplied by Lady Ilene Campbell, of Stonefield, Argyllshire. Some of this I sowed in the open ground in my nursery and some in boxes in my greenhouse.

“The latter came up well and some 500 or 600 plants were pricked out in the open in the spring. The seed sown in the open failed to germinate. Owing to the war and the shortage of labour, the plants are still in my nursery.

“What I have so far learnt is this:—

“1. The most successful way of raising plants from seed is to sow in boxes in a cool or heated greenhouse.

“2. The plant grows luxuriantly in cultivated peat soil.

“3. New Zealand friends tell me that with them the plant grows on both dry ground and in swamps and that it grows more luxuriantly in the swamps.

“My experience is that it grows best in a well drained and cultivated peat soil. I have planted some in a wet peat and they are growing, but much more slowly than those on a drained though moist soil. It may be that the ground is *too* wet for the young plants, but as they get older and larger they will dry the ground to a certain extent and may then possibly beat those on the drier land.

“4. From my limited experience I should say that if planting roots, split off a large clump with leaves 4 ft. to 6 ft. long, it is advisable to cut off the old leaves about a foot or 15 in. from the ground before planting, taking care not to injure the top of the new young leaf which will be coming between them.

“5. I have two species under cultivation, the ordinary *Phormium tenax*—the Powerscourt variety—of this I have three kinds; and *Phormium tenax Colensoi*. The latter is very much shorter in the leaf and is probably not worth cultivating from an economic point of view.

“One of my varieties of the ordinary New Zealand flax I obtained from Mr. Osgood Mackenzie, of Inverewe, Poolewe, Ross-shire, and was grown from seed sent him by an old shepherd who went to New Zealand. It is very like the Powerscourt one and may be the same, but at Inverewe it produced leaves 8 ft. long, and none of my others are more than 6 ft.

“I have had no experience as to the proper distance apart to plant for economic purposes, but from the way the plant

grows with me I should say that it should not be planted any closer than 8 ft. between the lines and 6 ft. in the lines. This point can only be settled satisfactorily by actual trial, and no doubt different districts will require different distances.

"If *Phormium tenax* is being grown commercially it would be advisable to plant in sheltered places or to have quick-growing hedges for shelter—as otherwise the ends of the taller leaves get frayed with the winter gales. To pick these leaves out of the bulk would cost labour, and if they were not picked out their darkened ends would deteriorate the quality of the bulk and so reduce price."

It seems likely that as *Phormium tenax* is amenable to cultivation in Wigtownshire and Argyllshire it would prove successful in selected spots in the Hebrides, where conditions would appear to be favourable for its growth.

In confirmation of the statements made by Lord Ventry in his account of the experiments he has made in Co. Kerry, the following report on Lord Ventry's plantations by the Irish Department of Agriculture is of value. This report was sent to Kew by the Board of Agriculture and Fisheries and is included here with their permission:—

"In no part of Ireland where New Zealand flax (*Phormium tenax*) has been tried does it appear to have made satisfactory growth, except on the estate of Lord Ventry at Burnham, Dingle. Sir Frederick Moore visited these plantations on 27-10-1915 and reported that, although the plants were grown under varying conditions as regards soil, aspect, etc., the growth was in all cases excellent, luxuriant and vigorous. The climate of the district, however, appeared to be exceptionally mild, and further, the soil was on the whole capable, when well treated, of growing good farm crops. Good crops of sound, clean potatoes had been lifted from land adjoining."

NEW ZEALAND FLAX IN CO. KERRY.

The Rt. Hon. Lord Ventry's Report.

It has long been apparent that New Zealand Flax (*Phormium tenax*) grows very vigorously in the extreme S.W. of Ireland.

In May, 1914, I divided a number of old plants which had been growing here for many years and planted them in an old neglected grass field, after ploughing and harrowing. I know now that this was too late to plant them out, the middle of March would have been much better. There was no rain to speak of until the end of June, but as soon as it came the plants started into growth. They are now (February, 1919) from 6½ to 8 ft. high, and are killing the heavy growth of coarse grass which until now has checked their full development. I expect them, if not cut, to be up to 9 ft. high by November, and to yield then at least 40 tons of leaves to the acre, though I have not yet had sufficient experience to enable me to make a very confident estimate.

In the autumn of 1914 I was given seed from New Zealand by a friend which failed to germinate owing, I think, to its being too old, but some fresh seed of my own grew very well, and I planted about five acres with these seedlings in the spring of 1918. These now

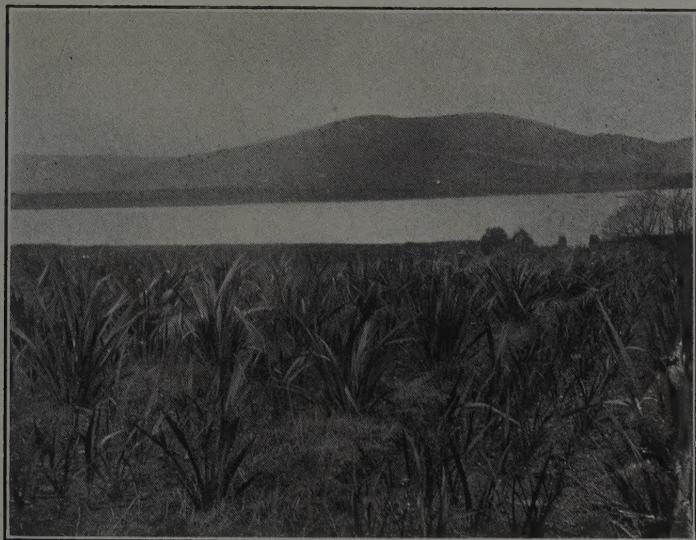


FIG. 3.

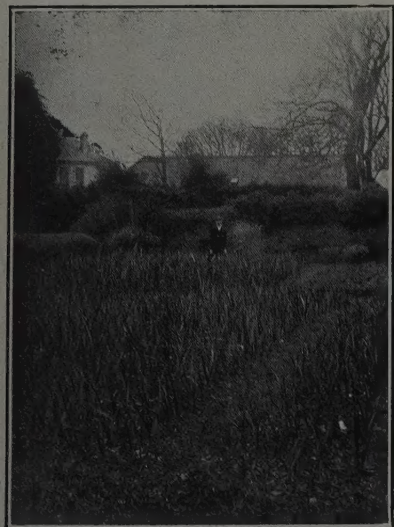


FIG. 4.

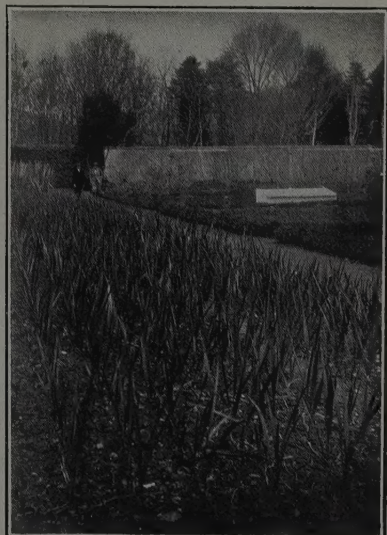


FIG. 5.

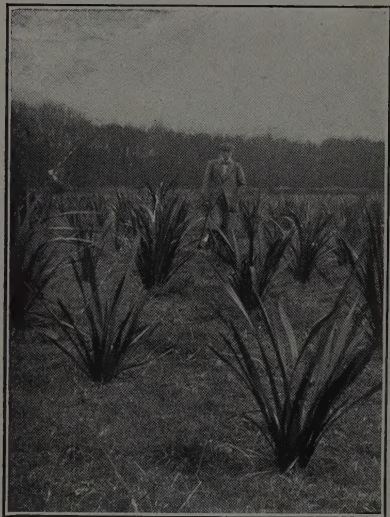


FIG. 6.

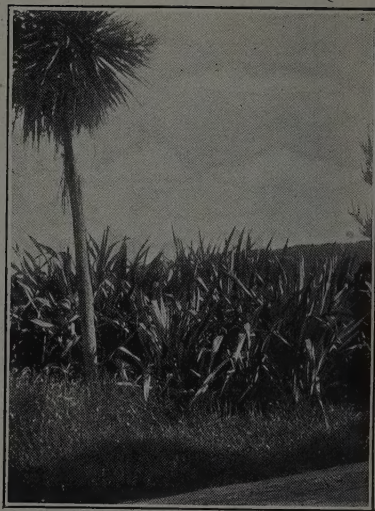


FIG. 7.



FIG. 8.

III.

average about 3 ft. high, with several "fans." A considerable number are 4 to 5 ft. high, with up to 12 "fans."

I can find no record of growth in New Zealand to beat this, and I think that, if cut at 5½ years from the date of sowing, they would yield a crop of several tons to the acre. Since 1914 I have grown seedlings every year and bought plants as well. I have lost a good many by planting them out too small and, for want of labour, not keeping them clean enough for the first year or two; but I have now (February, 1919) about 31 acres planted out and doing well. I have also strong seedlings enough for 15-20 acres more, which should be fit to plant out next autumn, and smaller seedlings for about a further 15 acres. Five-sixths of my plants are of the variety known in Ireland as "The Powerscourt Variety."

This (No. 1) is, in my opinion, the same as that grown by Mr. Wallace of Loch Ryan, near Stranraer.

I see it growing better inland than any other variety and believe it to be the hardiest. The leaves are very erect, the undersides of a light bluish-green and the edges and keel with a narrow black or dark red border.

It grows here up to 9 ft. high, with flower-stem 10-12 ft. high, and I think it is the variety called "Huhiroa" by the natives of New Zealand.

(2.) I have a small stock of another variety with a darker green leaf and a broader black edge. It promises well.

(3.) I have a few thousand of what I believe to be the "hill flax," native name "Tihore," of New Zealand. It does well here, but I never see a good plant of it inland. It does not often grow more than 6 ft. high, with flower stems 7-8 ft. high. The leaves are very erect and numerous and it has a general yellowish-green effect. It is said to make a very good fibre.

(4.) A small stock of a bronze or copper-coloured variety with a red or black edge and keel to the leaves. It will, I think, reach 9 or 10 ft. high here, and appears likely to make good fibre.

(5.) Two or three variegated varieties. Some of these are said to make good fibre in New Zealand. They do well here, but I have not seen them growing well inland.

(6.) The old common variety with drooping leaves, which has been grown in Co. Cork and Co. Kerry certainly for 50 years. It is probably the common "Swamp Flax" of New Zealand. It will not do inland, but here it yields a heavy crop. It grows well on poor wet soil and in exposed situations. The fibre, I think, is not of the best, but still it is of value.

I cut 16 tons of leaves of this variety in May, 1917, for the Irish Paper Mills Company, of Clondalkin, near Dublin. It was made into brown wrapping-paper and was very well reported on by Mr. J. Strachan, expert chemist to the Company. Mr. F. Becker, chairman of the company, fully concurred in this opinion. Mr. Strachan also considered that the flax leaves are well fitted for making special lines of high-class paper, such as banknotes, untearable labels, etc., the only obstacle being the present high price of the fibre.

At present, however, the main purpose for which this fibre is used is for making binder-twine and high grade string and cord. For these it is as good, if not better, than any other fibre. Fibre

suitable for binder-twine is at present imported from Manilla, Mexico, East Africa and New Zealand. The demand for it is rapidly increasing and is supplied with difficulty.

It may be said to be *the* key commodity, as without it the world's harvests cannot be reaped. It is estimated that 20,000 tons per annum are consumed in the United Kingdom alone.

It is difficult as yet to estimate the yield of fibre per acre in this country, but I am confident that, if fairly treated, it will be over 1 ton per acre per year and I hope for 2 tons. The yield in New Zealand varies greatly. Once established the plant yields crops for many years, nobody knows how many.

In 1914 I had about 60 lbs. of fibre made from my leaves and had it valued by Mr. F. Agar, director of Hindley & Co., Fibre Brokers, and by the Belfast Rope Works Company, who both handle large quantities of New Zealand fibre. They practically agreed in valuing it at just below the New Zealand Government grade "Good-fair." This is a good grade, worth then about £27 per ton, and just before the war, in July, 1914, £32 per ton. I may add that I can find no record of healthy well-grown leaves failing to produce good marketable fibre. I am much indebted to Mr. Agar for information and help in my undertaking.

Owing to the weight of the leaves they should be milled within a few miles of where they are grown. The cost of a mill I expect to be between £1000 and £2000, and a few acres of drying ground would be needed for each mill. To promote the growth of the crop on a considerable scale it would be necessary to raise a stock of plants for sale at reasonable rates. This would take time and care and might very properly, I think, be undertaken by, or assisted by Government.

Experimental plantings should be made on boggy and poor moorland soil. The growth of those plants I have in such situations is encouraging.

I have not been able to devote as much labour to its cultivation as I should have liked, and I feel confident that improved treatment would very much increase the rate of growth, especially of young plants.

Given a supply of strong young plants, I am convinced that the plant can be profitably grown by the farmers on the S.W. coast of Ireland.

It is impossible for the weather to be too wet for it and it has two great advantages over other crops; in the first place it can be harvested at any time of the year, and secondly, the work can be done in any sort of weather. Provided the crop is properly fenced and strong healthy stock is planted and kept free from heavy grass just round each plant for the first year, the growth of an acre or two would I think present no difficulties to the small farmer.

VENTRY.

EXPLANATION OF PLATES I, II AND III.

Fig. 1.—Plants of the "Powerscourt" variety of *Phormium tenax* bearing seed. The photograph was taken at Burnham, Dingle, in October, 1917. The plants are now (March, 1919) about 8 ft. high.

Fig. 2.—Divided plants of *Phormium*, 3 years and 1 month from the date of planting. A photograph taken 14 months later shows the same man nearly hidden by the plants.

„ 3.—Seedlings growing between the 6 ft. rows of older plants at Dingle, Co. Kerry. The seedlings will be lifted when strong enough to plant out.

„ 4.—Seedlings in the garden at Burnham, Dingle, 1½ and 2 years old.

„ 5.—Two-year old seedlings in the garden.

„ 6.—Seedlings from seed ripened at Burnham, sown in November, 1914. The average height in February, 1919, was 3 ft. with several “fans.” A considerable number of plants were 4 ft. 6 in. high, with up to 15 “fans.”

„ 7.—A clump which was cut down at the end of October, 1915. The photograph shows the condition of the clump in September, 1918.

„ 8.—An old plant of about 13 years' growth.

VIII.—SPECIES PLACED BY SACCARDO IN THE GENUS PHOMA.

W. B. GROVE.

The following notes on some of the foreign species placed by Saccardo in *Phoma* are the result of an examination of the specimens preserved under his names in the Kew Herbarium. Many of them belong to those received by Berkeley or Cooke from the United States during the last century, concerning which nothing has been published since their receipt and first description; upon them modern knowledge throws now a clearer light.

This investigation is a continuation of that begun three years ago, which found expression in the *Kew Bulletin*, 1917 (p. 49), under the title “The British Species of *Phomopsis*.” For this reason the species which belong to *Phomopsis* are placed first, followed by those which prove to belong to other genera. There are still many other species which have not yet been examined.

With regard to *Phomopsis* it may be mentioned here that the present list adds one more to the British species, and that the following names must be appended to those given in *Kew Bulletin*, 1917, p. 50, of the species in which both A and B spores have been observed (five of these have been already recorded in the *Journal of Botany*, 1918, p. 292):—

<i>P. ampelina</i>	<i>P. Pseudacaciae</i>
<i>P. Asparagi</i>	<i>P. pustulata</i>
<i>P. corticis</i>	<i>P. quercella</i>
<i>P. delitescens</i>	<i>P. Stewartii</i>
<i>P. Eres</i>	<i>P. subordinaria</i>
<i>P. oncostoma</i>	<i>P. venenosa</i>
<i>P. padina</i>	<i>P. viticola</i> , var.
<i>P. Pittospori</i>	<i>ampelopsidis</i> .

In further reference to the article in the *Kew Bulletin*, it is now clear that, as was suspected at the time, *Phoma Rosae*, Schulz. & Sacc. (p. 63) is the same species as *Phomopsis incarcerata*, p. 57; for specimens recently collected at Hereford show the latter occurring indifferently on the stems and on the prickles, with nearly the same character on both.

One feature which becomes clearer at every stage of this enquiry cannot but be regarded with satisfaction—that is, the gradual disappearance of many “species” of *Macrophoma*. This genus was founded merely upon the length of the spores (15 μ or more), and its formation by Berlese and Voglino, together with the similar cases afterwards concocted by the artless genius of Allescher, reminds one of the simpler arithmetical exercitations current in the lower classes of a kindergarten school. All that was required for such a feat was the ability to count up to fifteen and to write, or print, the word “MACROPHOMA.” Of course, if the size of the spore is indicative of and associated with other more profound differences of structure, it may become useful as a guide, and some species of *Macrophoma* will be firmly established upon that basis. But this is not the principle that was present in the minds of the authors. Most species assigned by them to *Macrophoma* will be found to be either errors of fact or young states of *Sphaeropsis*, *Diplodia*, etc. The compilation of this genus in 1886, so far as it took place from mere book knowledge, is a perfect instance of how not to do it. Such a procedure serves little purpose in any case, and least of all in the Fungi Imperfecti, which are destined in the distant future to disappear more or less completely from our lists.

The numbers prefixed to the species mentioned in the following pages are those of Saccardo's Sylloge, vol. iii. All the figures are magnified 600 times except where it is otherwise stated.

SPECIES TO BE TRANSFERRED TO PHOMOPSIS.

399. *Phoma oncostoma*, Thüm.

PHOMOPSIS ONCOSTOMA, v. Höhn. in Sitz. Akad. Wiss. Wien., 1906, cxv. 33. Trav. Flor. Ital. Crypt. Fung. p. 197. Died. Krypt. Mark Brand. ix. 267. Sydow, Mycoth. Germ. no. 1014!

Cytospora orthospora, Berk. & Curt. North Amer. Fung. no. 458 (exsicc. Pennsylv. Michener, no. 5158! New Jersey, no. 4681!). Sacc., Syll. iii. 272.

C. Robiniae, Schwein. p.p. (exsicc. Herb. Schwein.! and Pennsylv. Michener, no. 5132!).

Pycnidia gregarious or arranged in rows, pustular, covered, raising the epidermis considerably and at length bursting it by the broad obtuse dark-grey discoid apex, blackish, up to 500 μ diam.; texture thick, dark olivaceous. Spores fusoid or elliptic-fusoid, acute at both ends, mostly biguttulate, 8-10 \times 2-2.5 μ ; sporophores subulate, about twice as long.

On twigs and branches of *Robinia Pseudacacia*. Brit. Fr. Belg. Ital. Germ. U.S.A. The pycnidium of *Diaporthe oncostoma*, Eckl. = *Chorostate oncostoma*, Trav. loc.

The pycnidia of this species approach those of a *Cytospora*. They are not only lobed within and pseudolocellate, but are often clustered several together in one pustule with the ostioles emergent in a common disc. In fact, it stands in the same relation to a typical *Phomopsis* as *Chorostate* does to the other sections of *Diaporthe*. There is, moreover, an apparent stroma, which is sometimes greenish, but this seems to be part of the altered cortex, for the green tinge is due to plastids. The pycnidia are deeply seated, and in growing to the surface push up a large quantity of the cortex before them.

All the specimens in the Herbarium under the synonyms given above belong to the same species: they all have the same spores and sporophores, and differ merely in age. In the specimen of *Cytospora Robiniae*, ex herb. Schweinitz, which is old and exolute, the fusoid spores are very few, but they are accompanied by a few filiform hooked bodies exactly like *Phomopsis* B-spores, measuring about $18-20 \times 1 \mu$. These were seen and sketched by Berkeley. There are also specimens of some of the other species of *Cytospora* upon *Robinia*: of these *C. parva*, Berk. & Curt. (no. 3424!) is smaller and otherwise different, having broader and more "tip-cat"-like spores, approaching those of *Phomopsis strictica*, Trav., and *C. coccinea*, Fr., is quite different.

It is very possible that this *C. parva* is equal to *Phoma abnormis*, Sacc., and both are equivalent to *Phomopsis Pseudacaciae*, Trav., which has "tip-cat"-like spores. The latter species, which belongs to *Diaporthe fasciculata*, Nits., of the section *Euporthe*, is smaller than *P. oncostoma*, and is found on petioles as well as on twigs.

The conclusion is that there are two species of *Phomopsis* occurring on *Robinia*—branches, twigs, and petioles in the one case, branches and twigs in the other—the one tending to be unilocular, and belonging to *D. fasciculata*, the other to be plurilocular and belonging to *D. oncostoma*. This confirms the result arrived at by the study of the species in the former paper, viz., that the pycnidia of true *Diaporthe*, Trav. belong to typical *Phomopsis*, while those belonging to *Chorostate*, Trav. tend rather to resemble, more or less, *Fusicoccum* or *Cytospora*. Further examples of the latter case are seen in *Phomopsis quercina* and *P. fibrosa*, belonging respectively to *D. (Chorostate) leiphaemia* and *D. (Chorostate) fibrosa*. The former of these has various forms of pycnidia and spores, ranging from true *Phomopsis* to true *Fusicoccum*. This result might be made a fair ground for argument in favour of the generic separation of *Chorostate*, as adopted by Traverso. *Vide infra*, no. 433.

423. *Phoma melaleuca*, Berk. & Curt.

This is represented in Herb. Berk. by three specimens, all from U.S.A. and labelled in Berkeley's handwriting: Berkeley's only reason for lumping them together was that he recognised in them a common character which we know now to be that distinctive of *Phomopsis*.

These three are—(1) *Phomopsis viridarii*, Grove, in *Kew Bull.* 1917, no. 4096, on twigs of *Magnolia tripetala*, p. 67; (2) no.

5274, on branches of *Berberis*, is *Phomopsis berberina*, Grove (see below); and (3) no. 5185, on petioles of *Aralia spinosa*, is the one for which Berkeley's specific name *melaleuca* should be retained, as this species appears not to have been met with elsewhere.

PHOMOPSIS BERBERINA, Grove.

Phoma berberina, Sacc. & Roum. in Rev. Mycol. 1880, p. 191. Sacc. Syll. iii. 72.

Pycnidia scattered or loosely gregarious, without any stroma, subepidermal, globose-depressed, brownish-black, about 300 μ diam. Spores fusoid, acute at both ends, biguttulate, $7-8 \times 2 \mu$; sporophores at first ampulliform, tapering sharply upwards (i.e., strongly obclavate), $9-12 \times 3 \mu$ wide at the base, afterwards more elongate, subulate, $12-14 \times 1.5-2 \mu$, rising from a thick olivaceous stratum. (Fig. 1).

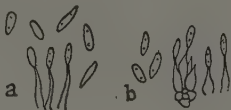


Fig. 1. *Phomopsis berberina*; a, from Roum. no. 1015; b, from Berk. no. 5274.

On branches of *Berberis*, Tarbes, France (Roum. no. 1015!); New England, Sprague (Herb. Berk. no. 5274!).

Certainly different from *Phomopsis detrusa*, Trav. Pycnidia very imperfect. All the English specimens which I have seen under the name *Phoma berberina* were not fully developed, but did not in any case belong to *Phomopsis*.

PHOMOPSIS MELALEUCA, Grove.

Phoma melaleuca, Berk. & Curt. in Grevill. 1873, ii. 82. Sacc., Syll. iii. 73, p.p.

Pycnidia scattered, oblong-depressed, 300-400 μ long, imperfect, black, covered by the epidermis and each surrounded by a deep brown stain, piercing the epidermis by the short ostiole. Spores broadly fusoid, acute at both ends, biguttulate, $7-9 \times 2.5-3 \mu$; sporophores subulate, $12-15 \times 2 \mu$. (Fig. 2).



P. melaleuca from Berk. no. 5185.

On petioles (not branches) of *Aralia spinosa*, Alabama, Peters (Herb. Berk. no. 5185!). This is not likely to belong to *Diaporthe Araliae*, E. & E., since that is a *Chorostate* (= *C. Araliae*, Trav.).

425. *Phoma Pittospori*, Cooke & Hark.

PHOMOPSIS PITTOSPORI, Grove.

Pycnidia gregarious, subglobose, obtuse, black, pierced by a round pore, covered, then disclosed as to the upper third, about $200\ \mu$ diam. A-spores, fusoid or lanceolate, acute at the ends, biguttulate, $6-8 \times 1.5\ \mu$; sporophores subulate, up to $20 \times 1.5\ \mu$; B-spores filiform, curved, hamate, or flexuous, $18-20 \times 1\ \mu$; sporophores conical, very short. (Fig. 3).

*P. Pittospori.*

On twigs of *Pittosporum*, California (Hark. no. 2294!).

The two kinds of spores occurred in the same pycnidium, the B-spores most abundantly. The latter resemble closely the sporophores of the A-spores; *in situ* they can, of course, be distinguished easily, but even when loose the sporophores are recognisable by the subulate base, which often contains vacuoles and tapers distinctly upwards. The pycnidium is not in the slightest degree papillate, but very obtuse, and ultimately the upper part of it is laid bare.

433. *Phoma padina*, Sacc.

PHOMOPSIS PADINA, Died. l.c. ix. 264.

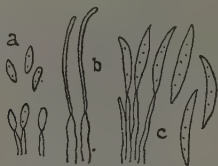
Under the name "*Phoma palina*," there is in the Herbarium a specimen "on dead branches of *Padus*" (Roum. Fung. Gall. sel. no. 493!), which is stated on the label to be *Sphaeria palina*, Fr. Syst. Myc. ii. 494. But there is evidently a confusion here between *S. palina* and *S. padina*, which both occur on the same page of Fries. On examination the specimen turns out to be possibly the same fungus as *Septomyxa padina*, Allesch. in Ber. Bayer. Bot. Gesell. 1892, ii. 6 (Sacc. Syll. xi. 573), though the spores are slightly longer and more acute at the ends than the description states. But in Roumeguère's *exsiccatum* there are true pycnidia (which do not exist in *Septomyxa*), scattered, subconical, erumpent, at length nearly free. In these were three kinds of spores:—

A-spores, fusoid, $7-9 \times 2.5-3\ \mu$, on rod-shaped sporophores as long as or occasionally longer than the spore.

B-spores, filiform, hooked, $25-30 \times 0.6-0.7\ \mu$, on rod-shaped sporophores about $15 \times 2\ \mu$.

C-spores, fusoid, acute at both ends, curved, at length

faintly 1-septate, granular, $20-22 \times 2.5-3 \mu$, on sporophores which are truly fasciculate, linear or tapering slightly upwards, $20-25 \times 1 \mu$. (Fig. 4).



P. Padina—a, A-spores; b, B-spores; c, C-spores;
all from Roum. no. 493.

The A-spores are those of *Phomopsis padina*, Died.; the B-spores are like those found in many species of that genus, but neither of these is what Allescher described. He seems to have met with only the C-spores, but according to Roumeguère's specimen these belong, not to a *Septomyxa*, but to a *Fusicoccum*. They are in shape like those of *Cryptomela atra* (Kunz.) Sacc., as figured by Corda (Sturm, Deutsch. Crypt. Fl. tab. 49), but singly are all but colourless, though faintly pinkish-brown in mass. Although all three kinds of spores were not seen in the same pycnidium, yet A and B spores were found together, and also B and C spores together, so that they all presumably belong to the same fungus, which is *Diaporthe (Chorostate) decorticans*, Sacc. & Roum., of which *Phomopsis padina*, Died. is considered the pycnidial stage.

It should be noticed that Allescher found what he calls *Myxosporium padinum* in company with the *Septomyxa*, of which it is evidently a mere early state, although he unwisely repudiates any suggestion that they are genetically connected. Possibly the *Fusicoccum* state is merely a variant of the *Septomyxa*, because it is well-known that a *Phomopsis* may be found both with and without a distinct pycnidium, according to its age.

This case is no doubt similar to that of *Diaporthe longirostis*, Sacc., which is also a *Chorostate*, and to which von Höhnelt and others assign as pycnidial forms the following "species":—

Phomopsis Tulasnei, v. Höhn.

Septomyxa Negundinis, Allesch.

„ *Tulasnei*, v. Höhn.

Myxosporium Späthianum, Allesch.

„ *Tulasnei*, Sacc., with its variety *monacense*, Allesch., all of which occur on branches, and to which may safely be added:—

Gloeosporium acerinum, Westd.

= *Marssonina acerina*, Bres.

as a leaf-form, differing from the branch-forms merely in being of a less complex construction.

A parallel but simpler case is also met with in *Diaporthe aesculicola* (Cooke) B. & V., which has the following pycnidia:—

Phoma diploidioides, Sacc.

Septomyxa aesculi, Sacc.

Diplodina truncata, Sacc.

All these cases are complicated by the difficulty (in addition to the change of spore-form) that there may or may not be a real pycnidial wall, according to the stage of development that has been reached.

466. *Phoma Ampelopsidis*, Sacc. and 470. *Phoma pallens*, B. & C.

P. Ampelopsidis, Sacc., was a new combination based on *Sphaeropsis Ampelopsidis*, Cooke & Ell. in Grevill. 1878, vi. 84, pl. 99. f. 8 (= *Macrophoma Ampelopsidis*, Berl. & Vogl. in Sacc. Syll. Addit., p. 306), but the species of Cooke and Ellis does not exist. The spores assigned to it by Cooke (*l.c.*) are the escaped ascospores of the accompanying *Sphaeria* which he mentions. It appears to be a *Physalospora*, but in view of the scantiness of the material present no description can be attempted. The naviculoid spores described and figured by Cooke could be seen both in and out of the asci; they measure $30\text{--}32 \times 10\text{--}11 \mu$, and are very granular (Fig. 5). There were none on sporophores.



Physalospora sp. from Cooke & Ellis's specimen named *Sphaeropsis Ampelopsidis*.

But on the same twigs of *Ampelopsis quinquefolia* there is a *Phomopsis* which differs from *P. viticola*, Sacc. (in Annal. Mycol. 1915, xiii. 118) in external appearance, especially in the totally undiscoloured epidermis. It may be described as follows:—

PHOMOPSIS VITICOLA, Sacc. var. AMPELOPSIDIS, Grove.

Pycnidia gregaria, valde imperfecta, subglobosa, 200–300 μ diam., innata, nigrescentia, convexa, vix papillata, epidermidem colore omnino immutatam levant, tandemque irregulariter findunt, at rarius supra eam extant: senio vertex dilabitur. Asporae copiosissimae elliptico-fusoideae vel sublanceolatae, utrinque acutae, ut plurimum rectae, biguttulatae, $8\text{--}9 \times 2 \mu$, sporophoris subulatis, usque 15 μ longis, infra ca. 2 μ latis suffultae: B-sporae filiformes, hamatae vel rarius flexuosae, $20\text{--}25 \times 1 \mu$, sporophoris brevibus suffultae.

Hab. in ramulis *Ampelopsidis quinquefoliae* (*Vitis hederaceae*), New Jersey, J. B. Ellis, no. 2704! A very typical *Phomopsis* and agreeing with *P. viticola* except for the total absence of discoloration in the epidermis.

Phoma pallens, Berk. & Curt. (South Carolina, Herb. Berk. no. 5015!) seems to be only a young state of this species, at least so far as the specimens on *Vitis* and *Ampelopsis* are concerned. The form on *Celastrus scandens*, referred to it by Berkeley (Pennsylvania, Michener, Herb. Berk. no. 4127!), though equally a *Phomopsis*, may be different, since it has distinctly larger and often triguttulate spores.

467. *Phoma ampelina*, Berk. & Curt.

PHOMOPSIS AMPELINA, Grove.

Pycnidia gregarious, oblong, black, about $200\ \mu$ long, immersed, each pycnidium surrounded by a blackish-brown stain, raising the shining discoloured epidermis and at length splitting it by the minute papillate ostiole which is pierced by a round pore. Spores elliptic-fusoid, scarcely acute at the ends, biguttulate, $8-10 \times 2-2.5\ \mu$; sporophores a little longer than the spore.

On twigs of *Vitis*, Pennsylvania, Michener (Herb. Berk. no. 4094!). No spores $12\ \mu$ long, such as are described by Berkeley, could be found. The pycnidia are longer than broad, and split the epidermis by a ragged orifice or in a somewhat hysteriiform manner. Allied to *P. viticola*, but different in external appearance.

473. *Phoma Edgworthiae*, Sacc.

PHOMOPSIS EDGORTHIAE, Grove.

On rotting twigs of *Edgworthia chrysantha*, Italy.

A typical *Phomopsis*, except that it is more clustered than usual. Spores $7-8 \times 2-2\frac{1}{2}\ \mu$; sporophores linear, $20-25 \times 1.5\ \mu$. No B-spores, such as are suggested by Saccardo's "basidiis filiformibus, $30 \times 1.5\ \mu$ " could be discerned.

510. *Phoma lirelliformis*, Sacc. f. *ribicola*, Sacc.

PHOMOPSIS RIBICOLA, Grove.

Pycnidia crowded, imperfect, black, narrow-lanceolate or linear, hysteriiform, up to 1 mm. long but not more than $80-100\ \mu$ wide, sometimes confluent in long lines, running parallel and longitudinally on the stem, immersed, then splitting the epidermis in narrow slits. Spores fusoid, narrowed, especially at one end, usually biguttulate, $7-8 \times 2.5\ \mu$; sporophores linear, $12-15 \times 2\ \mu$.

On twigs of *Ribes sanguineum*, Saintes, France (Rabenh. Fung. Eur. no. 2988!),

The slits in the epidermis are much narrower than in *Phomopsis hysteriola* (Sacc.), and are not placed transversely on the stem as in *P. aucubicola*, Grove, in *Kew Bull.* 1917, p. 67.

On the same sheet is Roum. Fung. Gall. exs. no. 3353! with the label "*Phoma lirelliformis*, f. *Rhamni Alaterni*," from the

same locality, on dry branches of *R. Alaternus*. But this particular exsiccatum showed nothing but *Diplodia clandestina*, D. & M. Fl. Alg. p. 575 (Sacc. Syll. iii. 333) with spores measuring $25-30 \times 10 \mu$.

530. *Phoma Diospyri*, Sacc.

PHOMA DIOSPYRI, *Grove*.

Pycnidia gregarious, immersed at the base among the whitish fibres of the wood, then nearly superficial, oblong, hysteriiform, rough, black, up to 400μ long. Spores fusoid, acute at both ends, sometimes biguttulate, $8-10 \times 2 \mu$; sporophores crowded, subulate, $12-16 \times 2 \mu$, rising from a yellowish proliferous stratum.

On bare wood of large branches of *Diospyros Lotus*, Padua (Sacc. Mycoth. Ven. no. 1209!).

In Sydow, Mycoth. March. nos. 2584! and 2797! on twigs of *Diospyros virginiana*, from Berlin, the pycnidia are immersed in the bark of younger branches, but the spores and sporophores are the same.

544. *Phoma imperialis*, Sacc.

PHOMOPSIS IMPERIALIS, *Grove*.

Phoma Paulowniae, Sacc. & Roum. in Mich. ii. 330 (non Thüm.)

Pycnidia gregarious, globose-depressed, black, about 300μ long, covered by the epidermis, which is blackened over and around it and at length pierced by the subpapillate pore. Spores oblong or subfusoid, scarcely acute but usually obtuse at the ends, sometimes biguttulate, $7-8 \times 2.5 \mu$; sporophores subulate, $12-15 \times 1.5-2 \mu$.

On petioles of *Paulownia imperialis*, France (Roum. Fung. Gall. no. 1018!).

This is one of those striking species which (if it be known that the spores are continuous and hyaline) can be assigned to *Phomopsis* at merely a naked-eye view.

560. *Phoma Ailanthi*, Sacc.

PHOMOPSIS AILANTHI, *Trav.* l.c. n. 196.

Pycnidia gregarious, subglobose, immersed, convex, pustular, black, $330-500 \mu$ diam., long covered by the unchanged epidermis which is at length burst at the summit by a small irregular pore. Spores elliptic-fusoid or sublanceolate, acute at both ends, not often biguttulate, $7-8 \times 2.2-2.5 \mu$; sporophores subulate, straight, $10-15 \times 2-2.5 \mu$.

On dead branches of *Ailanthus glandulosa*, New Jersey (Ell. & Ev. N. Amer. Fung. no. 2767!). The pycnidium of *Diaporthe (Chorostate) Ailanthi*, Sacc.

The dimensions of the sporophores, seen *in situ*, are as given; the filiform arcuate "basidia," mentioned by Saccardo ($25 \times 0.5 \mu$), must be the B-spores, but none of these were discovered.

566. *Phoma Broussonetiae*, Sacc.PHOMOPSIS BROUSSONETIAE, *Died.* l.c. ix. 249.

Pycnidia subgregarious or densely scattered, oblong, convex, 250-300 μ diam., thick-walled above, covered by the pallid epidermis which they raise considerably and render paler, then bursting it at the summit, but without projecting above it. Spores fusoid, acute at both ends, biguttulate, $8.9 \times 2 \mu$; sporophores subulate, somewhat curved, $16.20 \times 1.5.2 \mu$.

On twigs and branches of *Broussonetia papyrifera*, France (Roum. Fung. Gall. no. 3071!); Germany (Sydow, Mycoth. March. no. 2583!).

760. *Phoma venenosa*, Sacc.PHOMOPSIS VENENOSA, *Grove*.

Phoma mixta, Berk. & Curt. in Grevill. 1873, ii. 82 (f. in *Datura Stramonio*, Pennsylvania, Herb. Berk. no. 4331!).

Phlyctaena arcuata, Berk. in Herb. (f. in *Datura*).

Septoria phlyctaenoides, Berk. & Curt. in Grevill. iii. 10 p.p. (in Herb.)

? *Phoma Daturae*, Roll. & Fautr. in Rev. Mycol. 1893, p. 117. Sacc., Syll. xi. 490.

Phomopsis Daturae, Sacc. in Annal. Mycol. 1915, xiii. 118.

Pycnidia scattered or aggregated, oblong, black, about 250 μ long, depressed, covered, surrounded by a dark brown stain, piercing the epidermis only by the round pore. A-spores shortly fusoid, acute at both ends, often biguttulate, $6.7 \times 2 \mu$; sporophores rod-shaped or subulate, mostly straight, about $10 \times 1.5 \mu$; B-spores filiform, hooked, $20.25 \times 0.75.1 \mu$, on short sporophores.

On stems of *Datura Stramonium*, Pennsylvania, Michener, as above. The two kinds of spores were seen intermingled *in situ* in the same pycnidia. Roumeguère has issued (Toulouse, Fung. Gall. exs. no. 2836!) a *forma Hyoscyami*, on *Hyoscyamus niger*. Both these are accompanied by the incunabula of a *Diaporthe*.

Phoma Daturae, Roll. & Fautr., which is the same as *Phomopsis Daturae*, Sacc., appears to be an ally with rather larger spores ($8.12 \times 2.2.5 \mu$), though Fautrey remarks that "il est bien différent," probably because he examined specimens which did not show the beginnings of the *Diaporthe*.

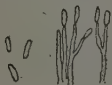
In a similar way to this, the other forms collected under the name *Phoma mixta*, on different hosts, should be assigned to various species of *Diaporthe*: e.g., that on *Liriodendron* (South Carolina, Curtis, Herb. Berk. no. 4963!) to *D. delitescens*, Bomm. Rouss. & Sacc.; that on *Robinia Pseudacacia* (Pennsylvania, Michener, Herb. Berk. no. 4177!) to *D. fasciculata* Nits., and so on. It is plain, by Berkeley's sketches on his herbarium sheets, that in most, if not all, of these cases he found both the A and the B spores together, whence the name *mixta*, which is applicable, however, to many species of *Phomopsis*. But, if he saw the B-spores alone, he named them *Septoria phlyctaenoides*, thereby placing many specimens under both names in succession.

SPECIES TO BE TRANSFERRED TO DENDROPHOMA.

563. *Phoma longipes*, Berk. & Curt.

DENDROPHOMA LONGIPES, Grove.

Pycnidia densely scattered or subconfluent, immersed, then erumpent, subglobose, obtuse or somewhat papillate, glabrous, black, about $200\ \mu$ diam.; texture thick and dark-brown. Spores subcylindrical, but rather irregular, $4-5 \times 0.75-1\ \mu$, borne at the apex of subulate sporophores which are fasciculate at the base, and occasionally (but not often) branched above, $12-15 \times 2\ \mu$. (Fig. 6).

*D. longipes*, from Berk. no. 2101.

On branches of *Morus rubra*, South Carolina (Herb. Berk. no. 2101!).

This is quite different from *Phomopsis moricola*, and is easily distinguished from *Phoma Mororum*, which has obsolete sporophores. It is closely allied to *Dendrophoma olivaceo-hirta*, Starb., but not identical with it, and has nothing to do with the ascophorous form which was confused under this latter name by Cooke. (This may be, as he says, *Massaria olivacea*, Cooke, in Grevill. xvii. 92; it has dark opaque-brown fusoid spores, about $50 \times 16\ \mu$. Schweinitz evidently sent out an ascophorous and a pycnidial form, both under the name *Sphaeria olivaceo-hirta*, Schw.).

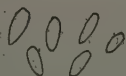
SPECIES TO BE TRANSFERRED TO DOTHIORELLA.

508. *Phoma diatrypea*, Sacc.

DOTHIORELLA DIATRYPEA, Grove.

Sphaeropsis diatrypea, Cooke & Ell. in Grevill. 1877, vi. 2, t. 95, f. 6.

Pycnidia subglobose, $300-400\ \mu$ diam., rather convex or even papillate above, blackish-brown, immersed 2-8 together in a dingy-brown stroma, which is oblong or lanceolate, longitudinally placed, erumpent and surrounded by the cleft epidermis. Spores very numerous, oblong-ellipsoid or oblong-cylindrical, rounded at the ends, hyaline, $9-11 \times 3-4\ \mu$; sporophores not seen. (Fig. 7):

*D. diatrypea*, from Ellis no. 2532.

On dead branches of *Chionanthus virginica*, J. B. Ellis, New Jersey (Ellis, no. 2532! in Herb. Cooke; Roum. Fung. Gall.

no. 4753!; Thüm. Mycoth. univ. no. 1286!; all forming part of the same collection, Jan. 1878).

On the same branches is *Botryodiplodia Chionanthi*, Grove, which is a true *Botryodiplodia*, having 2-12 pycnidia in each group, but is evidently the same as was issued by Ellis as no. 2531! and named *Diplodia Chionanthi*, C. & E. in Grevill. 1877, vi. 3. In no. 2531 the pycnidia are often single, and only occasionally gregarious, 2-4 together.

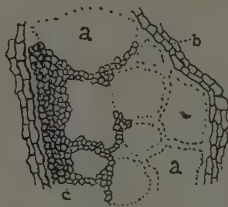
Cooke's figure (l.c.) is very exact, though no spores quite so large as he shows could be discovered. *Dothiorella* is in many cases only at an early stage of *Botryodiplodia*; thus *D. fraxinea* belongs to *B. Fraxini*, and *D. pyrenophora* to *B. pyrenophora*, etc. So here, probably, *Dothiorella diatrypea* belongs to *Botryodiplodia Chionanthi*, and the following species, *D. Crepini*, may belong to *Diplodia mutila*, Fr. & Mont., which shows some signs of being really a *Botryodiplodia*.

574. *Phoma Crepini*, Speg. & Roum.

DOTHIORELLA CREPINI, Grove.

? *Dothiorella populnea*, Thüm. Pilzf. Sibir. no. 791 (1880). Sacc., Syll. iii. 237.

Pycnidia single or crowded in erumpent botryoid groups of 3-12, girt by the erect laciniae of the burst epidermis, immersed in a common basal stroma, nearly free above, deep ink-black, shining, globose, subpapillate, 100-300 μ diam., pierced by a round apical pore, at length collapsed at apex. Spores very numerous, minute, oblong-cylindrical, straight or curved, i.e., sausage-shaped in profile, obtuse at both ends, faintly biguttulate, 2.5-4 \times 1-1.5 μ ; sporophores cylindrical, straight, erect, crowded, about twice as long as the spore or even more so. (Fig. 8).



D. Crepini, horizontal section of stroma $\times 40$; a. a, bases of pycnidia; b, cortex of host; c, stroma.

On bark of dead branches of *Populus fastigiata*, near Malmedy (Roum. Fung. sel. Gall. no. 654!). On bark of dry branches of *P. dilatata*, Belgium (Thüm. Mycoth. univ. no. 1681!). On dry branches of *P. tremula*, Germany (Fekl. Fung. Rhen. no. 2566!).

The spores are produced successively from the apex of the sporophores, and sometimes remain for a time in chains. There is often, in a group of pycnidia, one large pycnidium surrounded

by a ring of smaller ones: Fuckel suggests that in this case the central one is a young ascophore, but no evidence in favour of this idea could be found in the specimens examined.

This is said to be the pycnidial stage of *Cenangium populinum*, Fckl., but there seems to be some confusion here. Fuckel issued two fungi as imperfect stages of his *C. populinum*, both on *P. tremula*—no. 2566, which is the present species, and no. 1839! which is different (see Symb. Myc. p. 268, and Nachtr. ii. 55).

Phoma Crepini bears much resemblance to certain species of Dermateae; it has a decided basal stroma, and should therefore be placed in *Diothella*. *D. populae*, Sacc. Syll. iii. 237 (Sydow, Mycoth. March. nos. 417! and 1022!) is similar in some respects, apart from the spores, but the pycnidia are fewer, larger, dull brownish-black, and present a very different appearance to the eye. *D. populnea*, Thüm.; however, can hardly be anything but *D. Crepini*, though no specimens of it have been seen: if so, the name of the species should be that given by de Thümen.

SPECIES TO BE TRANSFERRED TO CYTOSPORA.

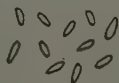
432. *Phoma allostoma*, Sacc.

Sphaeropsis allostoma, Lév. Ann. Sci. Nat. 1846, v. 294.

This is represented in Berkeley's herbarium by a specimen from the Botanic Gardens at Paris, named in Lévillé's own handwriting, on the bark of a large trunk of *Taxus baccata*. It is evidently a *Cytospora*, and appears to be identical with *C. Taxi*, Fckl., differing only in the fact that the pustules measure about 1 mm. across (instead of 2-3 mm.). The spores, however, are hardly "curved," but elliptic-linear and straight, though of about the right size. The fungus described under this name, *P. allostoma*, by Diedicke (Pilz. Mark Brand. p. 178) is obviously something quite different from this specimen of Lévillé, the pycnidia being given as 90-150 μ diam., and the spores being different.

Description of Lévillé's specimen, "*Sphaeropsis allostoma*."

Conceptacles scattered or gregarious, 1-1.5 mm. broad, very convex, covered, then emergent, irregular, black, the broad dingy-black disc pierced with one ostiole (rarely more) and surrounded by the laciniae of the bark; within is a sinuous chamber, surrounding a whitish columella (not always present); contents horny, grey. Spores very numerous, elliptic-linear, straight or in profile faintly curved, 6-8 \times 1.5-2 μ , supported on straight, crowded sporophores longer than the spore. (Fig. 9).



Spores from Lévillé's specimen.

The only specimen of *Valsa Taxi*, Fckl., I and II, that I have seen (Fckl. Fung. Rhen. no. 2347!) is very poor, but does not

so far as it goes, disagree with this identification. The fungus on *Ephedra andina* under this name (*P. allostoma*) in Herb. Kew is a *Coniothyrium*, described below:—

CONIOTHYRIUM EPHEDRINUM, Grove.

Pycnidia infrequenter sparsa, epidermide tecta, ligno insidentia, oblonga vel globosa, atra, 150-230 μ longa, rima brevi longitudinali depiscentia. Sporulae ovaes, copiosissimae, brunneolae, $3-4 \times 1 \mu$.

In ramulis *Ephedrae andinae*, in Horto Botanico Kewensi.

When the bark falls off, the base of the pycnidium is seen to be immersed in the wood; the ostiole is a pore which is more or less compressed to form a slit. The fungus seems to be allied to *C. peradenyccum*, Sacc. (Syll. iii. 319).

SPECIES TO BE TRANSFERRED TO DIPLODIA.

397. *Phoma clavuligera*, Sacc.

DIPLODIA CLAVULIGERA, Grove.

Sphaeropsis clavuligera, Berk. & Curt., Cuban Fungi, no. 562.

"*Phoma clavuligera*" is nothing but an early stage of a *Diplodia*. Berkeley no. 792 contains young *Sphaeropsis*-like spores. Nos. 791 and 793, which were issued by Berkeley as *Diplodia vulgaris*, Lév., are on the same host, *Dipteryx*, and no. 793 contains older, brown, 1-septate spores. The spores of no. 792 measure $20-25 \times 12-15 \mu$, those of no. 793 $22-25 \times 10-15 \mu$, but the two are obviously the same at different stages of growth, exactly as in the next two species. (Fig. 10).



D. clavuligera; a, from Berk. no. 792; b, from Berk. no. 793.

428. *Phoma micromegala*, Sacc.

DIPLODIA PINASTRI, Grove in Journ. Bot. 1916, p. 193.

Sphaeropsis micromegala, Berk. & Curt. in Grevill. 1874, ii. 180. On decorticated roots of *Pinus*, Alabama (Beaumont, Herb. Berk. no. 5090!).

This is undoubtedly *Diplodia Pinastri* compressed by its unusual site. Growing on the bared wood of the root, it seems to attack the cut ends of the rays, and assumes their outline, but in every other respect it agrees with that species. I have met with it besides on bark, leaves and cones of *Pinus*, preserving the same essential characters in each habitat. By observing how it changes as it develops by age, it can be readily shown that *Phoma Pinastri*, Lév. (1846). *Sphaeropsis Pinastri*, Sacc., *S. Ellisii*, Sacc. (1884), *Diplodia conigena*, Desm., and probably also *D. pinea*, Kickx, are all forms of the same species, to which now *Phoma micromegala* must be added. The spores of *D. Pinastri* are known to remain for a long time eseptate and nearly

colourless. Those of the Alabama specimen are not all hyaline, as Berkeley and Curtis assert; many of them have the yellowish-brown colour habitual with young *D. Pinastri* and its typical curved or irregular outline, and I found in the pycnidia at least one spore which was brown and uniseptate.

Phoma macrosperma (Karst.) Sacc., on *Abies excelsa*, is a similar fungus, and presumably also a *Diplodia*; and the same may be said of *P. excelsa*, Karst., but about these (no specimens being available) only suggestions can be made. The old system of putting all such *Sphaeropsidales* in *Phoma*, without paying any regard to the character of the spores, if only they were continuous and colourless, is now thoroughly discredited; to those who are familiar with the forms even the young spores display many signs which are significant of their future fate.

434. *Phoma persicina*, Sacc.

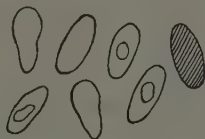
DIPLODIA PERSICINA, Grove.

Sphaeropsis persicina, Berk. & Curt. in Grevill. 1874, iii. 1.

Macrophoma persicina, Berl. & Vogl. in Sacc. Syll. Addit. p. 307.

Diplodia Persicae, Sacc. in Mich. ii. 267 (1881); Syll. iii. 341.

Pycnidia crowded, round, flattened, lens-shaped, then sub-globose, 120-250 μ diam., shining, black, covered, then just piercing the epidermis by the short papillate ostiole round which a whitish circle is left; texture rather thick and dark. Spores oblong, straight or faintly curved, obtuse at the ends, not thick-walled—pale-brown, continuous, 1-2-guttulate, 16-18 \times 7-9 μ (in Berkeley's specimen)—dark-brown, 1-septate, sometimes gently constricted, 18-20 \times 9 μ (in Roumeguère's specimen). (Fig. 11).



D. persicina, from Berk. no. 3422; nearly all the spores were pale brown.

On twigs of *Persica*, Pennsylvania (*Sphaeropsis persicina*, Herb. Berk. no. 3422!); on thin twigs of *Persica vulgaris*, France (Fautrey, Roum. Fung. Gall. sel. no. 5282!); Conegliano, Italy (Sacc.).

These are evidently the same species, the pycnidia as usual being larger on the thicker twigs, and the spores passing through the series of colours and forms characteristic of a *Diplodia*.

455. *Phoma fusigera*, Sacc.

Sphaeropsis fusigera, Berk. & Curt. in Grevill. 1874, ii. 181.

Macrophoma fusigera, Berl. & Vogl. in Sacc. Syll. Addit. p. 312.

This "species" is a mixture of two specimens, which, by inadvertence, Berkeley confused together. Both are, perhaps,

young *Diplodias*, but Berkeley seems to have united the spores of the one with the pycnidia of the other. The one of which he gives the host is probably merely a form of *Diplodia Crataegi*, Westd.

DIPLODIA CRATAEGI, Westd., in Kickx, Flor. Fland. i. 393. Sacc. Syll. iii. 340. f. PYRACANTHAE, m.

Pycnidia scattered, erumpent, globose, 400-500 μ diam., black, surrounded above by a reddish meal which arises from the cortex. Spores oblong or obovoid, rounded at the ends, olive-brown, 1-guttulate, not granular, 20-25 \times 9-10 μ ; sporophores hyaline, straight, 15-16 \times 2.5 μ . (Fig. 12).



D. Crataegi, from Berk. no. 4056. The spore on the right is young and colourless, the others are olive-brown.

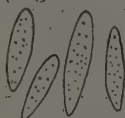
On branches of *Crataegus Pyracantha*, Pennsylvania, Michener (Herb. Berk. no. 4056! marked in Berkeley's handwriting "in Mesp. pyr.," i.e., on *Mespilus Pyracantha* = *Crataegus Pyracantha*; it is not on *Mespilus germanica*). Obviously an immature *Diplodia*.

Berkeley gives a sketch of a spore, showing it to be oblong and about 37.5 μ long. But there can be no doubt that his description in words (*l.c.*) was influenced by the specimen mentioned next, which is different and has much more fusiform spores than even the young spores of this species on *Crataegus*, and for which the name *Phoma fusigera* can provisionally be retained:—

PHOMA FUSIGERA, Sacc. emend. Grove.

Pycnidia oblong, black, about 200 μ long, immersed, then erumpent more or less in lines. Spores not numerous, fusoid, slightly more obtuse above, colourless, granular, eguttulate, 22-28 \times 6-7 μ , often slightly inequilateral; sporophores short.

On dead twigs and branches of *Wistaria*, South Carolina (Curtis, in Herb. Berk) (Fig. 13).



P. fusigera, from Curtis's specimens.

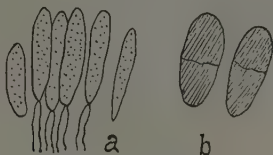
On these specimens there is no trace of red granular matter. It is almost certainly a young *Diplodia* but, although there is little doubt, one cannot assert with perfect confidence that it is an early state of *D. Wistariae*, Brun. (Sacc., Syll. iii. 335), since it is not exactly like the young spores of that species. On one of the older branches of *Wistaria* it is accompanied by an

immature pyrenomycete, showing asci with imperfect spores, which is, no doubt, *Botryosphaeria Wistariae* (Rehm) Sacc. Another specimen (Berk. no. 6250), bearing the same name, on culm of Lily, is nothing but immature *Diplodia herbarum*, Lév.

In the same cover are two other specimens, labelled "*Sphaeropsis fusispora*, C." (? MS. name only).

One of these, on *Rhus*, Poughkeepsie (Gerard, N. Amer. Fung. no. 176!) is immature *Botryodiplodia compressa* (Cooke) Sacc.

The other, on *Ailanthus*, Aiken, South Carolina (Ravenel no. 2136!) is immature *Botryodiplodia Ailanthi* (Cooke) Sacc. (Fig. 14).



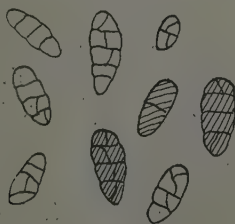
B. Ailanthi, from Roum. no. 2136; a, on small branches;
b, on older branches.

With reference to this latter species, it will be well to take this opportunity of replying to Saccardo's question (Syll. iii. 378) "*An diversa a Botr. scabrosa?*" It is quite different; *B. scabrosa* is large, rugged, and tuberculose, *B. Ailanthi* is in small compact pustules, much like those of *B. compressa*.

In connection with the examination of these specimens it became necessary to investigate *Diplodia Wistariae*, Brun. (in Rev. Mycol. iv. 226). The exsiccatum issued under this name by Roumeguère (Fung. Gall. exs. no. 3372!) yielded that species, but also a *Camarosporium* and a *Microdiplodia*, and on one occasion all three kinds of spores were found apparently in the same pycnidium.

CAMAROSPORIUM WISTARIAE, Grove sp. n.

Pycnidia solitaria, ca. 300 μ diam., globosa, emergentia, atra, nitida, papillata, pertusa, basi hyphis brunneis cincta, contextu crasso, molli, e cellulis minutis parenchymaticis conflato. Sporulae ovali-oblongae vel subcylindraceae, saepe curvatae, utrinque rotundatae, 1-septate, deinde 3-septate vel rarissime 4-septatae, postremo murali-divisae, vix constrictae, 15-22 \times 8-10 μ , achroae, posterius dilute brunneolae, sporophoris brevissimis suffultae. (Fig. 15).

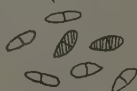


C. Wistariae.

Hab. in ramulis emortuis *Wistariae sinensis*, Bagnères de Luchon. Obviously not a further development of the *Diplodia*, since the sporophores are merely the inner cells of the pycnidial wall, and although the young spores are 1-septate (as usual), yet they are then quite unlike those of the *Diplodia*, being pale and translucent, not fuliginous.

MICRODIPLODIA WISTARIAE, Grove sp. n.

Pycnidia sparsa, usque 250 μ longa, rotundata vel oblonga, tecta, dein rima erumpentia, nigrescentia, contextu molli, minute parenchymatico. Sporulae oblongae vel ovali-fusoideae, altero saltem apice attenuata, dilute brunneolae, 1-septatae, non constrictae, 6-8 \times 2.5-3 μ , sporophoris subulatis, spora paullo longioribus suffultae. (Fig. 16).



M. *Wistariae*.

Hab. in ramulis emortuis *Wistariae*, ibidem.

The texture of the pycnidium is very similar to that of the *Camarosporium*. Exactly the same fungus was found intimately mixed with *Botryosphaeria wistariae*, Sacc. on a specimen from Aiken, South Carolina (H. W. Ravenel). The probability is that all the species mentioned here on *Wistaria* are stages of that pyrenomycete.

516. *Phoma hyalina*, Sacc.

Sphaeropsis hyalina, Berk. & Curt. in Grevill. 1874, ii. 179.

Macrophoma hyalina, Berk. & Vogl. in Sacc. Syll. Addit. p. 315.

Under the name *Sphaeropsis hyalina* Berkeley issued three specimens, as follows:—

I. On *Fraxinus americana*, Pennsylvania, Michener (Herb. Berk. no. 4201!). This is young *Diplodia inquinans*, Westd. Mature brown 1-septate spores, measuring 25-30 \times 10-15 μ , are to be found mixed with the nearly hyaline spores of which Berkeley makes a sketch. The pycnidia stand mostly singly, as they often do in British specimens. But in other specimens every possible stage can be observed on the same branch, between this and *Botryodiplodia fraxini*, Sacc., and an extensive investigation of numerous examples from many quarters has convinced me that the following are all synonyms of one and the same species, in varying states of growth:—

Botryodiplodia fraxini, Sacc., Syll. iii. 378.

Diplodia fraxini, Fr. Sum. Veg. Sc. p. 417.

Botryodiplodia sphaeroides, Sacc., Syll. iii. 379.

Dothiora sphaeroides, Cooke, Handb. p. 429 (non Fr.).

Macrophoma fraxini, Delacr. Bull. Soc. Myc. Fr. 1890, p. 140.

Diplodia inquinans, Westd. Not. ii. p. 14.

Discula macrosperma (Peck) Sacc. var. *fraxini*, Gr. in Journ. Bot. 1912, p. 52.

Diplodia diatrype, Lév. Ann. Sci. Nat. 1846, p. 292 (f. in *Fraxino*).

II. On *Ribes rubrum*, Pennsylvania, Michener (Herb. Berk. no. 4093!). This is young *Diplodia Ribis*, Sacc., from which *D. Grossulariae*, Sacc. Schulz. does not seem to differ in any respect.

III. On *Viburnum dentatum*, Pennsylvania, Michener (Herb. Berk. no. 4208!). This is a *Botryodiplodia* similar to, if not identical with, *Diplodia Lantanae*, Fekl. Symb. Myc. p. 395, but with the pycnidia evidently immersed in a kind of black stroma. It may be that all species of *Botryodiplodia* have a *Diplodia*-form and that this one should be called *Botryodiplodia Lantanae* (Fekl.). In a similar way it seems likely that all species of *Diplodia* have an earlier small-spored form which would be classed as *Microdiplodia*; the recognition of this probability would help in the understanding of recent discoveries in the latter genus.

SPECIES TO BE TRANSFERRED TO RHABDOSPORA.

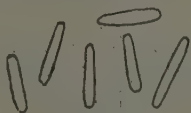
537. *Phoma Baculum*, Sacc.

RHABDOSPORA. BACULUM, Grove.

Sphaeropsis Baculum, Ger. in Grevill. 1877, v. 151.

Macrophoma Baculum, Berl. & Vogl. in Sacc. Syll. Addit. p. 312.

Pycnidia gregarious, up to 500 μ diam., very black, obtuse, erumpent, but closely surrounded by the epidermis. Spores numerous, cylindrical, straight, obtuse or even truncate at the ends, 14-20 \times 2.5-3 μ . (Fig. 17).



R. Baculum.

On branches of *Catalpa*, New Jersey (Gerard, no. 168!).

This species is certainly a *Rhabdospora*, not a *Phoma*; the texture of the pycnidium is very thick and dark. It is accompanied on the branches by a species of *Eutypella*.

SPECIES TO BE TRANSFERRED TO PSEUDODIPLODIA.

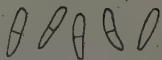
540. *Phoma consors*, Sacc.

PSEUDODIPLODIA LIGNIARIA, Karst., Symb. Myc. Fenn. xv. 156 f. AMERICANA, f. nov.

Phoma consorta, Cooke & Ell. in Grevill. 1876, iv. 180, pl. 68, f. 6.

Pycnidia gregaria, 2-5 breviter longitudinaliter seriata, rarissime solitaria, subglobosa vel oblonga, usque 200 μ lata, atra, basi ligno immersa, emergentia fibrisque sericeis cincta,

rugosa, obtusa, poro. tandem lato pertusa, postremo dilapsa foveolamque albidam in ligno relinquentia, contextu, mollissimo, olivaceo. Sporulae lineares, utrinque obtusiusculae, saepe curvulae, biguttulatae, continuae, dein medio 1-septatae, $10-14 \times 3-3.5 \mu$, singulae achroae, sed coacervatae dilute olivaceae. (Fig. 18).



P. ligniaria, f. *americana*.

Hab. in ligno decorticato *Aceris*, New Jersey (Ellis, no. 2138!).

The similarity of this specimen, in the texture of the pycnidium and the form of the spores, to my *Pseudodiplodia corticis* (see Sacc., Syll. x. 409) leads me to place it in the same genus, while its minuteness shows that it is closely allied to *P. ligniaria*, Karst., though with spores only half as wide as in that species.

SPECIES TO BE TRANSFERRED TO GLOEOSPORIUM.

489. *Phoma Aurantiorum*, Sacc.

There can be no doubt that Saccardo was right in thinking this to be identical with his *Gloeosporium intermedium*, which is, however, a mere form of *G. Aurantiorum*, Westd., concerning which he was misled by Penzig. Three distinct exsiccata, under the name *Sphaeropsis Aurantiorum*, on dry branches of *Citrus*, were examined, viz., the original issue of Dr. Marcucci, dated 1866, and Rabenh. Fung. Eur. no. 1330, both from gardens, Tortoli, Italy, and also Roum. Fung. Gall. no. 90, France, dated 1878: all gave the same result. There is no pycnidium; the spores measure $14-17 \times 5-6 \mu$. and the sporophores are of about the same length: both of them are those indicative of a *Gloeosporium*. The synonymy will therefore be as follows:—

GLOEOSPORIUM AURANTIORUM, Westd. in Bull. Acad. Roy. Belg. 1854, vol. xxi. no. 19. Sacc., Syll. iii. 702.

G. Hendersonii, B. & Br., Ann. Nat. Hist. 1878, i. 26. Sacc., Syll. iii. 702.

G. intermedium, Sacc. in Mich. ii. 118 (1880); Syll. iii. 702; Fung. Ital. t. 1043.

Sphaeropsis Aurantiorum, Rabenh. no. xxiii. in Marcucci, Unio Itin., Crypt. exs. (1866).

Phoma Aurantiorum, Sacc., Syll. iii. 83.

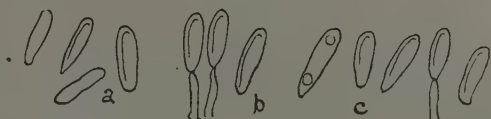
G. Hesperidearum, Catt., Micet. Agrum. p. 12 (*non vidi*). Sacc., Syll. iii. 702; Fung. Ital. t. 1186.

Berkeley's original specimen of *G. Hendersonii* (Herb. Berk. no. 3642!) is exactly the same as *G. Aurantiorum* (Westd. Herb. Crypt. Belg. no. 1188!), both being on half-dead leaves, though the descriptions given are somewhat different, and that given by Penzig at second hand (Mich. ii. 447) is quite unlike, unless one amends it by correcting the length of the spores from " 3μ " to 13μ . The original description of Westendorp (*l.c.*) gives the spore-measurements as the equivalents of $10-15 \times 5 \mu$. The

specimens issued by Marcucci and Roumeguère are on twigs, but are practically identical with those on leaves. Moreover, judging by the descriptions and figures, *G. Hesperidearum* Catt. is not different, and *G. intermedium*, Sacc. differs only in the sometimes bordered spots, a distinction which arises merely from its occurrence on younger and fresher leaves.

Description of the British specimens, "*G. Hendersonii*. B. & Br."

No distinct spots on the dry leaves. Pustules mainly hypophyllous, densely scattered over the leaf, roundish, 150-230 μ diam., fuscous, surrounded when young by a blackish line, blackish when old, flat, then bullate and erumpent. Spores cylindric-ellipsoid, rounded at both ends, with a faint yellowish tint in mass, often biguttulate, 14-18 \times 5-6 μ ; sporophores about as long. (Fig. 19).



G. Aurantiorum; a, from Rab. no. 1830; b, from Roum. no. 90; c, from Berk. no. 3642.

On dying leaves of Orange, in a conservatory, Milton, Norths. (Berkeley, Herb. no. 3642!).

SPECIES TO BE TRANSFERRED TO COLLETO- TRICHUM.

562. *Phoma tertia*, Sacc.

Sphaeropsis tertia, Cooke in Greville. 1883. xii. 22.

Macrophoma tertia, Berl. & Vogl. in Sacc. Syll. Addit. p. 307.

The specimens referred to *S. tertia* by Cooke, on twigs of *Ailanthus*, Aiken, South Carolina (H. W. Ravenel, Fung. N. Amer. no. 2172!), are infested with at least three fungi: (1) a *Colletotrichum*, (2) a *Laestadia* (see below), and (3) a *Diplodia*.

The first of these is the one examined and described by Cooke, which, therefore (if distinct), should bear the name *Colletotrichum tertium*. There are two described species which are very similar, both occurring on petioles of *Ailanthus glandulosa*, (1) *C. Ailanthi*, Togn. Second Contr. Micol. Tosc. p. 16 (in Atti Istit. Bot. Pavia, 1899, v. 16) and (2) *Vermicularia petiolicola*, Brun. Sphaerops. Char. 1889, p. 39 (Sacc., Syll. xiv. 908). The former, however, is credited by the author with falcate spores, and the latter has much longer, darker, more numerous, conspicuous bristles, and differs greatly in outward appearance. See Journ. Bot. 1919, p. 341.

(1). *COLLETRICHUM TERTIUM*, Grove.

Pustules densely scattered, flat, round, black, paler in the centre, 100-120 μ diam., disc surrounded by a ring of inconspicuous setae, covered, then emergently bursting the epidermis; setae few (sometimes wanting altogether), tapering to a point,

converging over the disc, olivaceous, paler upwards, very unequal, averaging $60-80\ \mu$ long, $5\ \mu$ wide at base, septate. Spores straight or rarely curvuluous, cylindric-ellipsoid, obtuse at both ends or tapering at base, granular within, $15-25 \times 3.5-5\ \mu$; sporophores subconical, $8-10 \times 3.5-5\ \mu$.



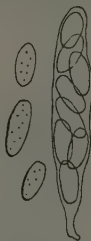
C. tertium.

On small branches of *Ailanthus* (as above).

(2). The pyrenomycete, accompanying this is:—

LAESTADIA AILANTHI, Grove sp. n.

Perithecia subdense sparsa, membranacea, lentiformia, atra, ca. $150\ \mu$ diam., tecta, dein erumpentia. Asci clavulati, $60 \times 10\ \mu$ paraphysibus nullis visis. Sporidia disticha, ovali-fusoida, intus granulosa ac leviter guttulata, $12-14 \times 4.5\ \mu$. (Fig. 21).



L. Ailanthi.

Hab. in ramulis *Ailanthi*, ut supra.

In company with the *Colletotrichum*. The similarity of the spores of these two species is very great, only those of the *Laestadia* are a little shorter, broader, and more fusoid in shape. To the naked eye the size and general appearance of the two fungi are also very similar, and they are mingled indiscriminately on the twigs.

(3). The *Diplodia* referred to is *Diplodia ailanthina*, Speg. (Sacc. Syll. iii. 332) in all essential respects, but would be better described as a non-caespitose form of

BOTRYODIPLODIA AILANTHI, Sacc. (var. *SIMPLEX*, m.).

The pycnidia are much smaller and less erumpent, and at most subgregarious (not in clusters); the spores are longer and broader ($28-32 \times 12-14 \mu$). In *Botryodiplodia Fraxini* it is possible to trace all imaginable forms intermediate between the so-called *Macrophoma Fraxini* and the most congested state; as has been shown in another place, facts require us to believe that a fungus of this group can vary from a scattered to a fasciculate state, from one which has colourless spores (when young) up to one which has dark brown spores (when mature), and from continuous to uniseptate spores, all these being mere time-phases of the same species and often to be found intermingled on the same twig or branch. The same thing is no doubt true of the species on *Ailanthus*; there is always a tendency in both for the simpler forms to grow upon the smaller branchlets.

A few short notes on other species which have been examined may now be added:—

442. *Phoma enteroleuca*, Sacc.

This is represented in the Herbarium by four specimens, all different, and none of them agreeing with Saccardo's description, which seems to be that of an abnormal state of some common species in which the cavity of the pycnidium was filled with a subsclerotial growth of cells, such as is not infrequently met with, and which is in most cases the preparation for the production of ascospores. Probably the "species" can never be recognised again with certainty.

447. *Phoma Rubi*, Westd.

"*Phoma Ruborum*, Westd.," ex errore in Sacc., Syll. iii. 76.

This specimen of Westendorp, on small branches of *Rubus*, is a *Cytospora*, and is indistinguishable from some of the forms assigned to *C. ambiens* which appear on *Rubus*; the spores measure about $6 \times 1 \mu$, though sometimes larger.

Phoma Ruborum, Roum. Fung. Gall. no. 3563! is quite different; it has hyaline didymous spores and a disc surrounded by a few olivaceous setae.

459. *Phoma Granati*, Sacc.

Macrophoma Granati, Berl. & Vogl. in Sacc. Syll. Addit. p. 315.

The description is correct, except that the spores are often 1-guttulate, faintly coloured in mass, $10-15 \times 4-5 \mu$. (Fig. 22.)



P. Granati.

460. *Phoma Eucalypti*, Cooke & Harkn.

Certainly not a *Phoma*; a vague mycelial growth, in which few and uncertain spores and absolutely no pycnidium could be detected.

461. *Phoma Eucalyptica*, Sacc.

Coniothyrium Eucalypti, Thüm. 1879, Moller, no. 401!

Specimens very imperfect, with few pycnidia or spores. But, on the other hand, there were a large number of perithecia of *Didymella recedens*, Sacc., with asci and biseriata spores, $16 \times 3 \mu$, bearing at each end appendages 1 or 2 μ long. (Fig. 22.



D. recedens, from Moller, no. 401.

465. *Phoma longispora*, Cooke. *Leptothyrium longisporum*, Thüm.

Macrophoma longispora, Berl. & Vogl. in Sacc. Syll. Addit. p. 312.

There are, under this name, a number of specimens (Ravenel, no. 2605!), as issued by Cooke, on branches of *Vitis aestivalis*, from Aiken, South Carolina. On these no spores like those described by Thümen could be detected. But there was a considerable quantity (mostly immature) of *Guignardia Bidwellii* (Ellis) V. & R. = *Physalospora Bidwellii*, Sacc., Syll. i. 441. Not a few asci and spores were found quite mature, and agreeing exactly with the descriptions and figures. As these specimens were issued in 1879, while Dr. Bidwell found the perithecia for the first time in 1880, it is evident that Ravenel really collected them first. His specimens are on the stems, which are surrounded and covered by vast numbers of perithecia.

469. *Phoma confluens*, Berk. & Curt.

The specimens in Herb. Berk. (no. 5616!) are very imperfect; this species should be deleted.

478. *Phoma fraxinea*, Sacc.

So far as the specimens, Roumeguère, no. 4350!, are concerned, this does not differ from *Cytospora ambiens*, Sacc. on the same host.

484. *Phoma Syringae*, Berk. & Curt. (see Sacc., Syll. iii. 82, sub *Phoma syringica*).

This specimen (Herb. Berk. no. 3191!), from South Carolina, is *Phomopsis depressa*, Trav., not *Phoma syringica*, Thüm. It has biguttulate fusoid spores, $7-9 \times 2-2.5 \mu$.

490. *Phoma Limonis*, Thüm.

This is represented in Herb. Kew by a specimen from de Thümen (Gorizia, Mycoth. univ. no. 1193!), on which there are at least four apparently different minute fungi (one of them *Metasphaeria papulosa*, Sacc.); but none of them agrees with the description of the *Phoma*.

533. *Phoma macropus*, Berk. & Curt.

On an unknown host (New England, Sprague, Herb. Berk. no. 5695!). The external appearance resembles Berkeley's description, but no spores or sporophores such as he assigns to it, nor any others, could be found. This species should be deleted.

551. *Phoma tamaricella*, Sacc.

There cannot be the slightest doubt, after examination of the specimens, that this is merely the same as *P. tamaricina*, Thüm.

558. *Phoma stictina*, Sacc.

Coccularia stictica, Berk. in Grevill. 1874, ii. 97.

Represented by two exsiccata (Herb. Berk. nos. 1532! and 2235!). On these nothing is apparent but nodular subsclerotial mycelial growths.

559. *Phoma sphaerospora*, Sacc.

On this specimen (Roum. Fung. Gall. no. 3969!), on samarae (not branches) of *Ailanthus*, nothing is visible but knots of mycelium and various other stages of a *Pleospora* (not *P. herbarum*).

561. *Phoma ailanthina*, Thüm.

On examining Thüm. Mycoth. unic. no. 989! there could be found only a species of *Coniothyrium*, with a small quantity of another (undeterminable) fungus. Those species of *Coniothyrium* which have nearly colourless spores when young have often been mistaken for a *Phoma*, as here.

IX.—THE TRUE MAHOGANIES.

R. A. ROLFE.

Of late years extensive planting of Mahogany trees has taken place in Trinidad and some other colonies, and numerous specimens and fruits have been received at Kew with the enquiry as to whether they represent the true plant. Mahogany has

long been known as the timber of a tree called botanically *Swietenia Mahagoni* Jacq., usually said to be a native of the West Indies and the adjacent coasts of Central America, but the term has also been extended to other red-brown timbers possessing somewhat similar properties, some of them belonging to other genera of *Meliaceae* and some to quite different families. The term, however, was originally applied to the West Indian tree, the timber of which has been known for upwards of 300 years, and under the name of Spanish Mahogany, early became famous for the construction of articles of furniture. At a somewhat later date British Honduras became famous as a source of Mahogany, which until 1886 was generally regarded as the timber of *Swietenia Mahagoni*. In that year, however, Sir George King described and figured a new species under the name of *Swietenia macrophylla*, this having been grown in the Royal Botanic Gardens, Calcutta, from seeds collected in Honduras. Since then it has been generally recognised that Honduras Mahogany is specifically different from the West Indian tree. There is also a third species, *S. humilis*, Zucc., a native of Western Mexico, which was thought to be in cultivation at Calcutta. Specimens of the Calcutta tree, however, including fruits, have recently been received at Kew, and prove to be a form of *S. Mahagoni*, Jacq. Further species formerly referred to *Swietenia* have now been transferred to other genera. The present paper, however, is limited to the species of *Swietenia* proper, to which what may be termed true Mahoganies belong.

1. *Swietenia Mahagoni*, Jacq. (Enum. Pl. Carib. p. 20), dates from 1760, being based on the *Arbor foliis pinnatis nullo impari Alam claudente*, &c., Catesby (Nat. Hist. Carolina, Florida and the Bahama Islands, ii. p. 81, t. 81), published six years earlier. It is called the Mahogany tree, and is said to grow in the Bahamas and other countries. Catesby remarked: "The Excellency of this Wood for all Domestick Uses is now sufficiently known in England: And at the Bahama Islands, and other Countries, where it grows naturally, it is in no less Esteem for Shipbuilding, having Properties . . . viz., Durableness, resisting Gunshots, and burying the Shot without Splintering." The coloured figure, which is good, shows a branch with flower and fruit, and also a Mistletoe which is said to grow on Mahogany and other trees in the Bahamas.

It is said that the earliest specimens of Mahogany were brought home by Sir Walter Raleigh on his return from Trinidad in 1595 (Dict. Nat. Biogr. xlvii. p. 194). The name, however, does not seem to have been used previous to 1671, when John Ogilby (America, p. 338), remarks "Here [in Jamaica] are . . . the most curious and rich sort of Woods, as Cedar, Mohogeney," (&c.).

P. Browne, in 1789 (Hist. Jam. p. 158), calling it *Cedrela* 2, states that "Mahogany grew formerly very common in Jamaica, and while it could be had in the low lands, and brought to market at an easy rate, furnished a very considerable branch of the exports of that Island." This is followed by an excellent

account of the tree and its timber. He then goes on to speak of "another *Cedrela*" discovered by Mr. Houston near the Gulf of Honduras, which is apparently identical with *Swietenia macrophylla*.

In 1824 Kunth mentions *Swietenia Mahagoni* as growing in Mexico (Syn. Pl. *Æquinoct.* iii. p. 219). The references cited are correct, but the diagnosis and habitat evidently belong to *S. humilis*, Zucc., for he describes the leaflets of the plant collected by Humboldt and Bonpland as "acuminato-subulatis," and remarks "Crescit prope Acapulco Mexicanorum, portum Oceani Pacifici."

In the same year De Candolle alluded to figures by Gaertner and Moçino & Sesse as showing the fruit dehiscing at the apex, and asked whether two species might not have been confused or whether the dehiscence was variable (*Prodr.* i. p. 625). The figure of Moçino & Sesse we have not seen, but that of Gaertner represents the West Indian *Swietenia Mahagoni*, and is dehiscing at both ends, like specimens now preserved at Kew.

In 1830 Sir William Hooker published an exhaustive account of the Mahogany tree, accompanied by two plates prepared from drawings made in St. Vincent by the Rev. L. Guilding (*Bot. Misc.* i. pp. 21-32, tt. 16, 17), and here, after an account of the extensive use of Jamaica Mahogany, he remarks: "Now, I believe, a very large portion of the Mahogany imported into Great Britain is derived from the Honduras, where it is unquestionably produced in most abundance." On a later page allusion is made to Browne's remarks, and it is added, "If this be what we call the Honduras Mahogany, and different from that of Jamaica, it is much to be lamented that its botanical characters are not yet known to us." This is the plant now known as *S. macrophylla*, King.

In 1879 Hemsley enumerated *Swietenia Mahagoni* as Central American (*Biol. Centr.-Amer.* i. p. 183), but the Honduras specimens cited belong to *S. macrophylla*, King, and those from Acapulco and Nicaragua to *S. humilis*, Zucc.

Complete materials of a *Swietenia*, which has long been cultivated at Calcutta under the name of *S. humilis*, have been sent to Kew by Lt.-Col. A. T. Gage, and seem to represent a dwarf form of *S. Mahagoni*, the leaflets and fruits being very similar in general character. It is not the *S. humilis*, Zucc.

The following are references to the literature and synonymy of *S. Mahagoni*, including such figures as are accessible to us:—

Swietenia Mahagoni, Jacq., *Enum. Pl. Carib.* p. 30; Linn. *Sp. Pl.* ed. 2, p. 548; Cav. *Diss.* p. 365, t. 209; Gaertn. *Carp.* ii. p. 89, t. 96; Hayne *Arzn. Gewächse*, i. t. 19; DC. *Prodr.* i. p. 625; Woodv. *Med.* ed. 2, iii. p. 620, t. 220; Desc. *Antil.* ii. p. 125, t. 99; Dict. *Sc. Nat.* xxviii. p. 81, t. 170; Tussac. *Antil.* iv. p. 65, t. 23; Hook. *Bot. Misc.* i. pp. 21-32, tt. 16, 17; Spach, *Hist. Nat. Veg.* iii. p. 164, Atlas, t. 21; Schnitzl. *Ic. Fam. Nat.* iii. t. 226, fig. 1; Nutt. *Sylva*, ii. p. 45, t. 75; DC. *Monogr. Phan.* i. p. 723, t. 8, fig. 11; Engl. & Prantl. *Pflanzenfam.* iii. p. 274, fig. 153.

The species is widely diffused, occurring in the Keys of S.

Florida, the Bahamas, Cuba, the Cayman Islands, Jamaica (said to be common on the plains and lower hills up to 3000 ft.), Hispaniola (Hayti and San Domingo), Porto Rico, St. Thomas, St. Croix, Martinique, St. Vincent, and Trinidad, though according to Crueger it is not indigenous in the latter island. De Candolle adds "Peru, near Pazuzo, Ruiz in h. Berol.", but this requires confirmation. The other localities, Mexico and Honduras, mentioned in various works, belong to the two following species.

2. *Swietenia humilis*, Zucc., was described and figured somewhere between 1831 and 1836 (Abh. Akad. Muench. ii. p. 355, tt. 7A, 7B), being based on materials collected by Karwinski in dry regions at 1000 ft. elevation near Tehuantepec, on the coast of the Pacific Ocean. It is described as a medium-sized tree, some 20 to 30 ft. high, with a trunk scarcely two feet in diameter, and the wood hard as in Mahogany. It was said to flower in February and to mature its fruits in the same month a year later. This species is characterised by its moderate-sized, very acuminate leaflets and by the very distinctly umbonate fruits. There are specimens at Kew from Taretan, in the Province of Oaxaca, collected by Prof. A. Duges, in 1883, bearing the native name "Cobano"; from Tuxtla, in the province of Chiapas, collected by Ed. Seler, and from Realejo (or Corinto), N.W. Nicaragua, collected by Dr. Sinclair. The latter is labelled "Mahogany Tree," and is cited by Hemsley under *S. Mahagoni*, Jacq. It would be interesting to ascertain whether this is the source of what is known as Nicaragua Mahogany. All these localities are on the Pacific Coast, as is also Acapulco, where Humboldt and Bonpland collected a Mahogany that is suspected to belong to this species (Kunth, Syn. Pl. Æquinoct. iii. p. 219). This and the Nicaraguan plant are cited by Hemsley under *S. Mahagoni* (Biol. Centr. Amer. i. p. 183). Another figure is Schnitzl. Ic. Fam. Nat. iii. t. 226, fig. 2, 4, 5, 7, 8, 18, 21, 22.

De Candolle cites as a synonym of this species *Swietenia multijuga*, Schiede (Linnaea, iv. p. 578), but this is a species of *Cedrela*. It was afterwards called *Cedrela odorata*, L.? (Schlecht. & Cham. in Linnaea, vi. p. 422), and later (as it is different from *C. odorata*, L.) *C. mexicana*, Roem. (Syn. Monogr. Hesperid. p. 47). There is a fruiting specimen of *S. multijuga* in the Natural History Museum at South Kensington, the leaves having eight pairs of alternate, very acuminate leaflets, and the fruits and seeds are wholly typical of the genus *Cedrela*. Of this Schiede remarked: "It is abundant at Papantla, Estero, and probably in the whole region, and is known by the name of Cedro. The wood of this tree is a browish colour, is easy to work and supplies the place of the Pines in the tract of coast. It must not be confounded with the Cedro of the Tierra fria, which is *Taxodium distichum*." The locality, it will be noted, is on the Atlantic coast of Mexico.

He also mentions a similar hard wood, called Caoba, perhaps produced by another species of the genus *Swietenia*, but he did not know the tree which produced it, though it was said

to grow not far from Papantla. This record is particularly interesting, because there is a specimen at Kew from the Herbarium of J. N. Rovirosa (n. 181), labelled "*Caoba incolarum*. Habitat. Comun en las cercainas del pueblo de Tepitan (Tabasco), Mexico, Feb. 14, 1888," which enables Schiede's "*Caoba*" to be definitely identified. Though labelled *Swietenia Mahagoni* it is a specimen of *S. macrophylla*, King.

3. *S. macrophylla*, King.—In 1886 Sir George King figured and described a new species of *Swietenia* under the name of *S. macrophylla* (Hook. Ic. Plant. t. 1550). The tree had been grown in the Botanic Garden, Calcutta, from seeds stated to have been collected in Honduras in 1872. *S. Mahagoni* was also grown at Calcutta, and it was pointed out that the Honduras plant had leaves twice as large as the other, with still larger leaflets, in 5 or 6 pairs, not in 4, and that both capsules and seeds were larger. It also flowered a month earlier than *S. Mahagoni* and seeded freely, whereas the other rarely seeded there at all. The differences were observed as soon as the seedlings were a few inches high, they grew much more rapidly, and were planted out as *Swietenia* species. They also grew three times as fast as *S. Mahagoni*, and in their twelfth year had attained a height of 20 ft. and had begun to flower freely, and a year later produced capsules. *S. Mahagoni*, at Calcutta, did not seed until 30 or 40 years old, and at all times very sparingly. This is the species which is at present being extensively planted in Trinidad and elsewhere. It now remains to collect the threads of its earlier history.

In P. Browne's History of Jamaica, published in 1789, we find (p. 159) a *Cedrela* n. 3, *Caroli foliolo ampliori, fructu pentagono*, Houst. apud Mill., of which it is remarked: "This plant does not grow in Jamaica, and is only inserted here to show that there is another species of the kind known: it was discovered by Mr. Houston near the Gulf of Honduras, where it grows very large." Whether this really represents *Swietenia macrophylla*, King, is not quite clear, for no trace can be found of a *Swietenia* in Houston's MSS., and plants at the British Museum, together with the absence of any mark to the Cedrelas in the British Museum copy of Miller's Gardeners' Dictionary, would indicate that no specimens were found in Miller's Herbarium in the same establishment, for it is on record (Journ. Bot. 1897, p. 225) "someone (probably Dryander) has marked off in the Gardeners' Dictionary the species received from Miller." It is not quite certain that the species alluded to by Browne is a *Swietenia*, for Miller's 3, *Cedrus (Alaternifolius) foliis alternis simplicibus cordato-ovatis acutis*, which is said to have been discovered by the late Dr. Houston at Campeachy, must have been different. It is reiterated that the leaves are single, while in the two preceding ones they are described as pinnate. The trees are said to be "eighty feet or upward, leafless on Houston's first visit, but on his second visit clothed with verdure, but with no appearance of flowers, so he was at a loss to know what genus it belonged to." Miller, however, remarked: "As the

fruit of this tree agrees exactly with those of the two former species [the Barbadoes Cedar-tree and the Mahogany], I have ventured to join it to them." And it is added, "We have no account of the wood of this tree, whether it is ever used in buildings, or for other purposes, as there have been few persons of any curiosity in that country, the cutters of logwood being the chief people who inhabit there, from whom there can be little known of the produce." The above reference is to the sixth, or 1771, edition of Miller, and there is no addition to the history in later editions.

There is evidence that Honduras Mahogany was known before Houston visited Campeachy. Sir Daniel Morris in 1883 remarked, "British Honduras began, some two hundred years ago, as a logwood and mahogany-cutting settlement" (Brit. Honduras, p. 1), and a few pages later (p. 4) "Additional articles to the Treaty of 1783 were made in 1786, at a convention held in London, whereby the right of cutting Mahogany was formally granted." It was, however, not distinguished from the West Indian species, for it is further remarked (p. 61) "Chief amongst the timber trees of the colony comes the mahogany (*Swietenia mahagoni*), which, with logwood, forms the staple article of export. The average quantity of mahogany shipped from British Honduras during the last five years amounts to nearly 3,000,000 feet, of the annual value of £30,000. The best qualities of mahogany . . . come from the limestone soils of the north of Belize; those from the south, and especially from the Mosquito Coast, being deficient in density and fine grain, are known in England as baywood."

In 1829 Sir William Hooker included the localities of all the three species under *S. Mahagoni*, but he gave some details of Honduras Mahogany, referring to Browne's remarks as to its distinctness, adding that workmen made an important distinction between the two woods, and that the Jamaica kind was the most valuable.

Apart from Sir George King's description of *S. macrophylla*, the only other reference to the question under consideration that we have found is in the West Indian Agricultural News for 1902, where, in a note entitled "Jamaica and Barbados Mahogany" (i. p. 54) we read, "It has been shown by Mr. Hart at Trinidad that the Mahogany trees so commonly grown at Jamaica, Barbados and elsewhere in the West Indies, are somewhat different from the Mahogany trees of British Honduras. The latter are said to be stronger-growing, while the leaves are larger and of a different shape." Since that time the differences between the two species have been fully recognised.

Very little is known about the distribution of *Swietenia macrophylla*, but besides the specimens from Tabasco and Honduras, preserved at Kew, there is also one from Cartagena, on the north coast of Colombia, east of Panama. This was sent by M. Antoine under the name of Mahogany, and if correctly localised and indigenous there, would indicate a possible wide distribution of the species in the countries bordering on the Caribbean sea. Unless there is more than a single species,

S. macrophylla is evidently the source of Honduras and Tabasco Mahogany, both well known on the market, but other Central American woods are known under the names of Costa Rica, Nicaragua, Guatemala and Panama Mahogany, the botanical source of which is in doubt. Colombia Mahogany, though shipped from Cartagena, is not a *Swietenia*, but the produce of *Cariniania pyriformis*, Miers, belonging to the family *Lecythidaceae*. It is said to be cut in the former state of Bolivar, 100 to 200 miles inland, and shipped from Cartagena.

Very close to *Swietenia macrophylla*, if not a form of the same, is a plant sent for determination by Sir Norman Lamont, who raised it from seeds of the second consignment obtained by the Trinidad Department of Agriculture from Honduras, somewhere about 1905. It is said to be about equal in height to undoubted *S. macrophylla*, planted at the same time, but is rather more branching and the branches have a less pronounced vertical habit. The leaves are rather smaller than in *S. macrophylla*, the inflorescence denser and the flowers rather smaller, but the general resemblance is so close as to suggest that it is only a varietal difference. The tree flowered profusely in 1918, but only a single fruit set, which has been sent to Kew, and cannot be separated by any essential character.

A tree with very similar leaflets is cultivated at Madras, a barren specimen, labelled "*S. macrophylla*, G. King, introduced, A. H. G., Madras, July, 1897," being preserved at Kew.

It would be interesting to identify the trees which produce other Central American Mahoganies, for example, Costa Rica, Nicaragua, Guatemala and Panama Mahogany, and for this flowering and fruiting specimens are desired. The term Mahogany is now applied to the timber of so many trees that nothing short of the actual materials will serve to identify them. All the timbers named may not belong to *Swietenia*, but in any case it is desirable that their botanical source should be ascertained.

X.—MISCELLANEOUS NOTES.

E. H. WILSON.—We learn that Mr. E. H. Wilson has been appointed Assistant Director of the Arnold Arboretum, Jamaica Plain, Mass., U.S.A.

Drawings of Indian Plants.—A set of about 600 water-colour drawings of Indian plants has recently been acquired for Kew. They are evidently the work of several artists, some of them native, others European, and appear to have been at one time the property of Claude Martin, who was born at Lyons on Jan. 4th, 1731, went to India in 1751 and, as an officer of the English East India Company, served in the Carnatic wars. In 1763 he obtained an ensign's commission in the Bengal Army, in which at length he became Major-General, retiring on half-pay in 1776, when he was allowed to accept the post of superin-

tendent of the arsenal of the Nawab of Oudh at Lucknow, where he died on Sept. 13th, 1800. He bequeathed his fortune to found institutions—called “La Martinière”—for educating European children at Lucknow, Calcutta and Lyons. Most of the drawings have been named by Dr. William Roxburgh, who was superintendent of the Botanic Garden, Calcutta, 1793-1814, and described some new species in his “Flora Indica” from material obtained from Martin, who was living at Lucknow part of that time. Under *Andropogon Martini*, Roxb., l.c. sp. 277 (= *A. Schoenanthus*, var. *Martini*, Hook. f.), a note states:—“A native of the high lands of Balla-ghat. General Martin collected the seeds while there with the Army, during the last war with Tippo Sultan, and has reared abundance of it at Lucknow.” Roxburgh, in vol. iii. p. 421, when describing *Artemisia elegans* (= *A. scoparia*, Waldst. & Kit.), says:—“Received from General Martin at Lucknow under the name of Abbuttna.” Martin must have taken an interest in plants before he settled in Lucknow, for when describing *Caesalpinia sepiaria*, Roxburgh (l.c. ii. 360) calls it the Mysore Thorn and says that it “was introduced into Bengal from that country by General Martin, where it is now as common as it is in the Mysore country, and is used to make fences.” One drawing has attached to it an undated letter from Dr. Robert Bruce, a surgeon at Lucknow in Martin’s time, which reads thus:—“My dear Martin—The flower is very well done. It is called in botany by a pompous name, the *Gloriosa superba*, and is, I fancy, the most beautiful of all the Lily tribe. The paper is infinitely superior to the country kind for covering drawings. Having already some of it I won’t rob you of yours, but beg your acceptance of my best thanks. I have, however, kept one of the sheets which was of folio size just suited to the size of the drawing paper, which I shall send down to Calcutta as a muster. Yours ever, R. Bruce.”

The drawings appear to have passed into the possession of Sir Gore Ouseley, who went to India in 1787, where after a few years he became Major-Commandant in the service of Saadut Ali, Nawab of Oudh, and was stationed at Lucknow at the time that Martin lived there. He returned to England in 1805. Later the collection came into the hands of his son, Sir Frederick Arthur Gore Ouseley, Professor of Music at Oxford University, and afterwards into the possession of Mr. F. W. Barry, Assistant in the Library, Windsor Castle, from whom they have been acquired by Kew.

With this collection are other drawings on smaller-sized paper, representing plants from the Caucasus or Northern Persia, which may have been made for Sir Gore Ouseley, who (accompanied by his elder brother, Sir William Ouseley, as private secretary) was Ambassador-Extraordinary and Minister-Plenipotentiary to the Persian Court from 1810 to 1814, and was at Tabriz in Northern Persia in June, 1812. Many of these drawings are exquisitely finished.

O. H. W.